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EDITORIAL NOTES.

The Bicorporal "Sulphate of Ammonia Association."

As ever, "Union is Strength." Never in the history of sulphate of ammonia manufacture and trading has there been more necessity than at the present time for British producers to make by unity their competitive place in the markets of the world as strong and effective as possible. This is the view of those who are in a position to gather together present conditions and portents, and by their aid to investigate the prospects. It is the view that was formed by several prominent manufacturers a year or more ago; and advancing time yields increasing confirmation. Quite recently (on June 9 last) an editorial article appeared in the "JOURNAL," announcing the formation of a Sulphate of Ammonia Manufacturers' Association; and last Friday, at the general meeting of the Sulphate of Ammonia Committee, and of the Sulphate of Ammonia Manufacturers' Association, it was resolved to join forces with the new organization, to the extent of having the whole of the corporate sulphate of ammonia work of the British Isles under one organization, to be known as the "Sulphate of Ammonia Association," but with the work conducted on a bi-departmental system—selling and propaganda—and each department controlled by its own Committee, except as may be necessary when the Joint Committees will meet for consultation under the Chairman of the propaganda branch. Therefore, under this scheme, there need be no compulsion for any producers to give their adherence to the work of the Association under both heads until convinced of the propriety of doing so, and yet enabling all to continue to participate in the good work of propaganda, in which all makers are expected to join. It is, however, believed that the time is not far ahead when all the producers in the country will find it fit and prudent to be full members of the organization.

There is more to be said presently in this article on the subject of the position of the new development. As to the necessity for it, we will not, in view of the statement in our columns on June 9 last, do more than refer to it briefly. In the first place, while in the British Isles the gas undertakings are as an industry the largest manufacturers of sulphate of ammonia, they do not produce half the total quantity made annually. But the interests of the whole of the producers are of the mutual order, in view of the continuing expansion of production not only in our own country, but abroad. It is what is happening abroad, even more than what is happening in this country, that makes positively essential the concentration of commercial interests in an effective and authoritatively speaking British body. While, too, the output of sulphate of ammonia as a result of the carbonization of coal and more scientific methods of carbonization is continually increasing, the extraction of nitrogen from the atmosphere is not a negligible phantom, but a corporeal factor in the markets of artificial fertilizers to-day. There it is—actual, and not hypothetical, though so carefully guarded are the producing costs that it is impossible to get at any reliable information regarding them. But sulphate of ammonia makers in the coal and shale carbonizing industries must not be caught napping. Our largest markets are transmarine; and Germany is not to-day absorbing all its own production, and is, with us, looking beyond the seas for new markets. Germany has an organization that can speak and act commercially for the sulphate of ammonia producers of that country; and it is, under the conditions of to-day, in the interests of our friends in Germany, just as much as of the producers in these Isles, that we should have a similar organization here. The Sulphate of Ammonia Committee had not the requisite authority behind them. Propaganda work is necessary—and more than ever—for the development of markets; but something more than the methods and the instruments of propaganda are required at the back of an organization to-day to strengthen the trading relationships with other countries, and to meet those countries on common ground.

In the Sulphate of Ammonia Association (which has not been founded in haste, but is the result of many private conferences by men of position and knowledge in sulphate of ammonia production and trading), we have now such an organization, the operations of which are, as already said, to be conducted by two distinct Executive Committees—the Selling Committee and the Propaganda Committee. The names of the members of these Executive Committees for the ensuing year are set out on another page of to-day's issue, together with the enterprises to which they belong. We particularly desire to call attention to the membership of the Selling Committee. In the first place, it will be observed that, for carrying on the work, the country has been divided into five districts: (1) Scotland, which as a district is the largest contributor of production; (2) Newcastle and district; (3) Manchester district and Wales; (4) the Birmingham and Midlands district; and (5) London and the South of England. The representatives for these five areas form one of the strongest and most influential combinations of British sulphate of ammonia interests that could possibly be brought together; and they have the confidence of, and cover, every contributing industry. They cannot work for the interests of their own powerful concerns—whether gas undertakings, coke-ovens, collieries, shale-oil works, or chemical manufactories—without working for the advantage of all the membership of the selling part of the organization. The gas undertakings are favoured in having as the Chairman of the new Association Mr. D. Milne Watson, the General Manager of the Gas Light and Coke Company, who succeeded Mr. Thomas Milne in the chair of the Sulphate of Ammonia Committee. The Selling Committee already represent 210,000 tons of the 430,000 tons of sulphate equivalent now produced in this country, but it has to be remembered that certainly 50,000 tons of this (and probably more) never becomes actual sulphate of ammonia. Therefore it may be said that 210,000 tons have joined out of a total quantity of 380,000 at the outside; and that at this early stage of its existence! These 210,000 tons give the Committee a very concrete foundation and authority. The Propaganda Committee—*i.e.*, the old Sulphate of Ammonia Committee—represent a production of 304,000 tons; but there is no doubt whatever in the minds of those who are represented by the Selling Committee, that all those who see the general advantage of propaganda will also, without any other persuasion than experience, soon likewise see the benefit of adding their unit strength to the already considerable corporate strength of the Selling Committee, and that, in process of time, there will be but few British producers who will not appreciate the advantage to their undertaking of assisting to make the new Association's authority in the sulphate of ammonia markets of the world exactly co-equal with British production.

The Sulphate of Ammonia Committee (now the Propaganda Committee) did a very wise thing when deciding to bring, so to speak, the Manufacturers' Association under the same roof—thus forming a bicorporal organization under the title of the Sulphate of Ammonia Association. The points may, in conclusion, be emphasized: That the work of the two Committees is distinctive, and will be kept entirely separate; that the major part, and the most influential, of the enterprises represented by the Propaganda Committee recognize that the Selling Committee is a regular business organization, founded on sound commercial lines; that there is a large amount of work before it in looking after the interests of the membership; and that it will be effective in doing the best financially for its members, under any prevailing conditions, or whatever may be in store. Fully believing this ourselves, we hope that all sulphate of ammonia makers will, in their own interests, do their part by adherence in contributing to the fulness of power of the new organization.

For the convenience of those sulphate of ammonia or ammoniacal liquor producers who desire to place themselves in communication with the new Association, it may be mentioned that its staff is now located at the offices of the Gas Light and Coke Company, Horseferry Road, Westminster, in order that all the work may be under the closest surveillance of the Chairman, as was the case with the work of the Sulphate of Ammonia Committee under the late Chairman, Mr. Thomas Milne.

The Gas-Fire Hygienic Standard Firmly Established.

After the results of the gas-fire tests reproduced from the "Lancet" in our columns last week (p. 93), there will be no question that the suggested standard of hygienic efficiency for gas-fires first promulgated through our columns in 1912 has now become firmly established, inasmuch as it has been adopted, in practice, as a perfectly sound one in the very quarter from which the strongest opposition emanated. Let credit be given for the suggestion of the standard to the Davis Gas-Stove Company, who, on its publication, received the support not only of ourselves, but of several other very prominent gas-fire makers, on the grounds both of policy and of expediency. The sole point was that gas-fires constructed to pass the whole of the products of combustion through the flue-vent (no trace coming forward under the canopy) without the aid of elbows and lengths of flue-pipe, would be of greater service to the gas industry than fires requiring varied lengths of flue-pipe according to circumstances, and which varied lengths gas-fitters rarely allowed in order to fit individual circumstances. Then the amazing theorem was advanced from the one opposing quarter, that from a fire which carried off the whole of its products of combustion through the flue-vent without a flue-pipe attached a greater number of B.Th.U. would be wafted-up the chimney than from one that had a flue-pipe connected to it. This position has never been proved; but what has been proved, and proved even by those who kicked with immoderation against a higher standard for the determination of hygienic efficiency, is that the standard can be worked to—whether the fires are built for the scions of Mayfair (with traceable genealogical lines extending through centuries) or for the less fortunate habitats of the East-end of London—without any excess loss *viâ* the chimney of B.Th.U., or without a lowered room-heating efficiency.

There is all sincerity in saying that we are pleased to see the healthy and clean sheet that Messrs. John Wright and Co. and Messrs. Arden Hill and Co. show as a result of an examination of quite a number of fires by the particularly sensitive test which was devised by the "Lancet" laboratory staff, and which several gas undertakings have adopted for good-character determination in making purchases of fires and for testing fires *in situ*. Not one of the dozen fires submitted to the "Lancet" by the first-named firm show even a trace of escaping products from the corners of the canopies, even without so much as an elbow on the flue-nozzle, and the same with the four fires submitted by the second-named firm. This is as things should be; and confident are we that this working to the conditions of the hygienic efficiency standard will have a big influence upon the whole of the makers of gas-fires who have not brought all their types of fires into line with the standard. When patrons demand, necessity finds a means of complying—even at the expense of renouncing in practice a much-cherished, if mistaken, proposition. However, the standard is established, and practicability proved; and there is visible an infinite advantage in such a result.

There is one criticism to be made of the later "Lancet" tests compared with the earlier ones. A new condition has been incorporated in the tests, by the setting of the fires in a three-way screen, so as to protect them from back and side draughts. It is quite obvious that in the middle of a room the flue-vent might be exposed to draughts that might cause, even from the best of fires, a slight escape under the canopy. But really we cannot see why, in most test-rooms, a fire cannot be placed in such a position that no back-pressure by draught is occasioned at the flue-vent. As, however, vagrant currents of air are difficult to detect, perhaps it is as well to have protection to ensure absolute fairness to all fires—especially in view of the fact that the test itself must add something to the volume and density of the products of combustion, and so make the trial more severe than if only normal products were being dealt with. The tests which give such notably excellent results to the latest types of fires of the firms named were made under the protection of the three-way screen; while the fires included in the former tests [see "Journal" for April 14, pp. 96-99] had not the benefit of a sheltering screen. This being so, comparatively, there is an unfairness to the fires included in the former tests. If these fires were to be re-tested under the protection of a screen, they might show somewhat different results; and justice to them suggests that they ought to be so tested.

However, the precaution of the screen—in view of the delicacy of the "Lancet" test—should be noted by those gas managements that have found usefulness in the latter owing to its simplicity and efficiency. The summer holidays will soon be here and soon be of the past; and then gas managers will be considering the question of gas-fire purchases for the next winter season. In settling purchases, a clear canopy test without the aid of any flue-pipe or chimney to assist, will be a larger and more general requirement than hitherto.

Gas-Cookers—British and German.

The Continental contributor to the "Journal" who undertook the duty of preparing an account of the Munich Gas Exhibition has not so far discharged it; and we are anticipating that, when he does, he will have some interesting material to place before our readers. Meanwhile we are having it constantly thrown into our faces that the German makers of kitchen gas appliances are in the cooking lines outstripping British manufacturers. Our own representative had something to say about the matter a fortnight ago (p. 15). Now "R. W. E." in some ornately expressed thoughts in other columns, practically confirms him. Accompanying his article is a sketch by that clever artist, Mr. David Wilson—a sample of whose work, and that in the literary line of his brother Mr. C. M. Wilson, of the Aldershot Gas and Water Company, was published in the "Graphic" at the time of the National Gas Exhibition [see "Journal" Oct. 14 last, p. 113]—which sketch also suggests that there is something in the position of German gas-cooker design that should claim the attention of the British gas-cooker makers.

Now will our home makers of gas-cookers tell us whether there is anything in these direct and oblique hints as to the German makers rising superior to the British manufacturers in catering for the domestic kitchen, or are the views merely the result of enlarged imaginations in new surroundings and the presence of, to the British visitors to Munich, somewhat unaccustomed types of cooker? We should like to hear from British makers on the point, because "R. W. E." in his article—and we understand his views reflect those of other professional visitors to the Munich Gas Exhibition—appears to have, by comparison, formed the idea that our home makers of cookers and other gas-heated appliances for the preparation of food have become somewhat fossilized in their designs, and that they require to lift themselves out of the deep furrow formed by long years of consistent working to prevailing designs. But there is a vagueness about these allusions to certain superior characteristics of the German cookers; and more information is wanted. Says "R. W. E.": "Just a little addition here "and an extra ledge there, facilitating convenience and "economy, and they have an article that is a very fitting "adjunct to the ideal kitchen." Our own correspondent was enamoured of the light construction and clean appearance of the German cookers, and spoke of them as being built-up of white-enamelled sheet iron. The white enamel suggests the exhibition, and not hard kitchen wear. The light sheet iron and the white enamel do not impress us with the durability necessary to keep-down maintenance costs under the hiring system. For the purpose of passing judgment, we should want to see the condition of the cookers after (say) a twelvemonth's run under ordinary workaday use in the kitchen, and not as the stoves stood immaculate at the exhibition. We picture expansion and contraction causing the light sheet-iron sides to buckle, and to get out of the beautiful square-set appearance of the exhibition stove. We picture, too, the enamel cracking and getting chipped on the exterior, and steam and greasy-water spillings from the cooking utensils causing the enamel, through the surface crackings, to deteriorate somewhat quickly. The opinion at the moment is that the heavier cast-iron construction has something to be said for it from the point of view of maintenance as well as rate of depreciation.

Low first costs and light and clean appearance (when new) are not everything. We should like to know something about the heat efficiency of the German construction. A little addition here and an extra ledge there may facilitate convenience and economy. But such things do not make the cooker; and economy is looked for in the maximum of utility on the very lowest consumption of gas. We are of opinion that some of the German gas-cooker makers know as little about the efficiency of their ovens and boiling-rings as did our own gas-cooker makers a few years ago—before

certain of them began to investigate the matter, and found how considerably efficiencies varied in some constructions, and how far from the best standards were certain of the types. At the experimental works of the German Association, research is now being made into this very subject; but the results are not yet ready for publication. Among the experiments have been some on gas reduced to 370 B.Th.U. per cubic foot, and containing appropriate proportions of carbonic acid and nitrogen to resemble gas made from brown-coal or lignite. Gas of such calorific power is poor stuff as things go nowadays. But, even so, by varying the sizes of burner nipples, and adjusting the spacing between the bottom of the kettle and the burner, burner efficiencies of 54 per cent. were obtained—consuming the low calorific power gas at the rate of 18 cubic feet per hour. This is not by any means a bad boiling-burner efficiency. But in the comparison between British and German made cookers, the point that has been raised is not so much in regard to the burner-top as to the light build of the oven. There we should fancy the consumption of gas in relation to work done, owing to heat losses, would be somewhat heavy. But this is only a surmise. If our own makers are satisfied that there is nothing they can learn from their German compeers, we shall be glad to hear from them to that effect; if the German makers have anything to say to this criticism of their light construction—criticism confessedly written only on verbal report—we shall also be pleased to have their views. If one country can help the other in still further raising the efficiency and usefulness of the gas-cooker, then it would be to their mutual advantage.

There is an ambiguous point in the article by "R. W. E." He remarks that "in the 'infinite variety' and daintiness "of fittings—particularly in those fields where hitherto elec- "tricity has held almost undisputed sway—our German "friends hold a key to many doors as yet closed to us." That is a point upon which there might have been enlargement by specific mention of the character of the articles in question.

The Chances of Low-Temperature Systems.

In a review of Mr. Brame's book in last week's issue, on "Fuel: Solid, Liquid, and Gaseous," it was suggested by the reviewer that, if it is possible by low-temperature carbonization to produce gas, oil, ammonia, and coke in profitable quantities, there is no doubt that gas engineers should be to the front in adopting such processes. The reviewer proceeded to state an obvious fact as to the future witnessing enormous increases in the quantity of oil consumed for power purposes, and suggested that gas manufacturers must take care that they are in a position to supply. The taking "care" on the part of gas manufacturers must depend on the "if" and the "profitable" in the first proposition. If it is not "profitable" for the gas industry to enter into this business, it will not be profitable for other people; and if there is no profit in it, then the industry has not much to fear that, "as a result of the future development in oil pro- "duction, liquid fuels will enter into serious competition "with the products of the gas industry." At the same time, the attitude of the gas industry towards these various processes for the production of gas and oils from coals and cannels must undoubtedly be one of watching and close investigation; for all successful profit-earning additions to processes of coal carbonization must result in the weakening of the position of the gas industry in some of the markets in which they trade—unless demand makes *pari passu* progress with supply.

At the present time, as Mr. G. E. Foxwell was suggesting in the scrutiny he made, in another article published last week, of the position of these low-temperature processes, there is great lack of reliable information as to what they are technically capable of doing under working conditions. There is nothing before us yet but experimental data derived not from the working by ordinary carbonizing hands, but from the refinements and tuning-up that a small plant receives from the chemist or an investigating engineer who naturally looks and works for the maximum result, and will not regard anything less. When working-scale experience is available from one of the processes, then the gas engineer will be in a position and will be prepared to weigh the advantages, technically and commercially; but prior to that there is not the slightest chance of his taking any hazard by making a departure from his high-temperature working. Looking at the hazards, and considering the situation generally (so far as it can be considered at the present stage), if gas undertakings ever do adopt a low-temperature carbonizing system, it will not be so much on account of the demand for oil as on account of the increasing demand for gas resulting in the production of more coke of a brand for which the absorptive powers of the markets are not equal. This condition points to the possibility of any change in carbonization practice which incorporates a low-temperature system being accompanied by the utilization in a water-gas producer of part of the resulting coke containing a higher percentage of volatile matter than the ordinary material—after Professor Strache's double-gas process referred to in Mr. Foxwell's article. But it is manifest that this process, in order to realize gas equal to the calorific standard set up by Parliament, would necessitate an elaborate equipment, and complicate the operations of a gas-works. If, however, a new situation is opening-up for the gas industry through fresh fields of enterprise or, alternatively, competition, then it is for the gas industry to face it, and not rest complacently with the view that what has been successful in the past will be sufficient for the future. Therein is danger.

Turning from the aspect of prudent regard to the general outlook for low-temperature carbonization systems, it seems to us from present appearances that the products of these processes will be more open to competition, and more vulnerable, than those of the existing high-temperature process of the gas industry. Let us examine the field within view—not in a dogmatic spirit, or by putting ourselves beyond the right of revocation of opinion with fresh enlightenment produced by development. There are in effect two classes of low-temperature carbonization processes in the field—one represented by the Del Monte system, which proposes to carbonize cannels, shales, or peat for the primary production of motor spirit and oils, and secondarily of sulphate of ammonia, &c., the other, by the Coalite, the Tarless Fuels, the Richards, and similar systems, which propose to produce smokeless fuel, motor spirit and various oils, sulphate of ammonia, &c. With the first-named process, the gas industry cannot have anything to do. Any process that is adopted must render assistance to gas undertakings, in some form, in connection with their gas and coke business. This is an essential; and therefore (while as a competitor in certain fields the Del Monte process as now to be practised has interest) the only low-temperature processes which can be considered from the point of view of incorporation in the gas-works system must be the Coalite and its cognates. Now looking at these as competitors with the high-temperature process of gas-works, the point of view to take is as to the chances of their success worked independently of the gas industry. In the first place, what evidence have we that material retaining in it three or four times the volatile matter left in ordinary gas-works coke will find a ready market? Plants producing 36 tons of the material a week, perhaps more, offer no guide. In the population of these isles, there are no doubt a scattered number of people who would absorb in the aggregate a fairly considerable quantity. But the Gas Light and Coke Company, with all their business ramifications and distributory resources, did not find "Carbo" a paying proposition, and dropped its production. If such a fuel as is in view ever did obtain wide popularity, it would take years to bring that condition about; and the material would have to be retailed at a price that would tempt as against coal and ordinary coke. There competition does not end. Every year finds gas in a stronger position as a heating agent. Coal retailers and coal-stove makers acknowledge it is so. Given good markets for raw material and secondary products, there is no telling how strong the hold that a cheaper gas will obtain in domestic heating. Electricity, too, is trying to get a foothold. What with gas displacing coal for domestic purposes, with gas, electricity, and oil displacing coal for industrial uses, and with oil displacing coal for naval purposes, the coal retailers will be putting their heads together, should such a par-carbonized fuel come in as a further serious competitor, with the view of doing something to maintain for themselves so well-paying a domestic market for raw material. The cultivation of such a market would be contested inch by inch from all sides; and altogether it seems to us that independently working low-temperature carbonizing processes have but a very hazardous outlook.

Then there is the question of oil. Admittedly oil is going to become an enormously applied fuel; but there are large, affluent, and strongly-established interests opposed to any new competing venture. Already we see the first movement

in a reduction in the price of petrol—only by a penny. But by how many pennies will the price be reduced in order to squeeze out opposition, and make the position of the new competitors untenable, if they threaten to be potential ones? The development of fresh oil-bearing territory, and the provision of larger fleets of tank-steamers, do not help to gild the prospects of home-developed oils and motor spirit; nor does the movement that is being made by the Alcohol Motor Fuel Committee to build up a fund of £30,000 for research work in the production of alcohol from potatoes, maize, peat, and other substances. The Committee are of opinion that the introduction of alcohol as a fuel for the future is far more hopeful than that of benzol. Then we come to sulphate of ammonia, which is a factor in the situation. There, again, competition has reached a keener level; and the estimates of revenue from this source as applied to low-temperature systems have been on a higher scale than ruling market prices, which are not likely to vary considerably so far as can be seen. Speaking of the estimates for the low-temperature carbonization processes, all the items have been worked out at top prices, and no account taken of the effects of competition.

On the whole, from the position as seen at present, there does not appear to be much in the low-temperature systems to induce their adoption. There is, however, a good deal that is speculative; and in view of the opposition to which they will be exposed, there does not seem to be any brilliant chance for them of an extensive, independent, self-supporting existence. For them, the greatest hope is their grafting on to the gas industry; their next best hope, combination with collieries. The gas industry asks, Will it pay? Information at present available is insufficient for forming a reliable answer.

Waste of Fuel on Gas-Works.

The Birmingham Section of the Society of Chemical Industry, at their meeting in May, had an illuminating discussion on "Fuel: Gaseous, Liquid, and Solid." It was opened by Professor John W. Cobb (Livesey Professor) in a speech covering considerable interesting ground. The position occupied by the gas industry in fuel economics was well placed before the members of the section; but Dr. W. B. Davidson showed the members that there was in this connection one blot on its manufacturing operations. He characterized the wastage of fuel in gas-works as "tremendous." In Birmingham, he said, the amount required in heating the retorts was 100,000 tons per annum; and this amount could be reduced by the simple device of controlling the primary air, as by Brooke's air-regulator. At only one works of the Gas Department, the fuel consumption had, by means of the regulator, been reduced from 25,000 to 16,000 tons per annum—thus effecting a saving of about £5000. If the same thing were done at the whole of the Birmingham Gas-Works, there would be a saving of about 35,000 tons of fuel, or £20,000 per annum. We do not suppose that prior to the adoption of the Brooke's regulator, Birmingham was, in relation to its fuel account, in a worse position than other gas undertakings in the country. This being so, what would be the value of the fuel saved throughout the British gas industry, with Brooke's primary-air regulator in use in every gas-works?

Undue Preference Litigation.

The Long Eaton and the Ilford actions over the question of undue preference in electricity charges, and further (at Ilford only) in regard to acting *ultra vires* in the matter of hiring-out, have stirred the souls of the electricity supply fraternity; and there are suggestions afloat as to affording corporate protection or help for those who are accused of breaking the law. It is, of course, a strange idea to assist in the protection of law-breakers (if they are so); but the electrical profession harbour the idea that their law-breakers are somewhat different from others—they having acted as they have been doing on the ground of commercial expediency, which is just what the Legislators feared. The electrical industry has so got itself mixed up in an almost impenetrable forest of schemes and tariffs for developing its business that it has lost sight of the boundaries to pass which is to transgress. However, after the result in the Long Eaton case, some idea has been set afloat in electrical minds that perhaps there has been a certain display of undue preference, but that there is still uncertainty on the point. They are clamouring now to have "undue preference" clearly interpreted and defined for them; but it is extremely unkind of our electrical friends to have waited for this until gas undertakings, in their own just interests, had, through the Law Courts, to call a halt. One electrical contemporary a week or two ago urged the Incorporated Municipal Electrical Association to take up the matter; and the Honorary Secretary (Mr. H. Faraday Proctor) has written to say that some time ago he entered into the matter with the Clerk to the Long Eaton District Council, and more recently with Ilford. Mr. Proctor's intervention was evidently not much good in the Long Eaton case. "Electrical Engineering" now speaks of the Incorporated Municipal Electrical Association acting "officially" in this matter of assisting the two District Councils. By the way, our contemporary might note that it is not correct to say that the Gas Companies' Protection Association are organizing a campaign in connection with this matter.

The Silence of Company Promoters.

A necessary qualification for promoters of some forms of company is that of being able to hold one's tongue, and not to be drawn by the severest criticism. Not once since the United Gas-Works Development Company, Limited, began its disinterested mission of launching upon the public liliputian undertakings with towering capitals have we succeeded in drawing any of the members of that concern—not even Sir George W. Kekewich, K.C.B., D.C.L., J.P., the Chairman of certain of the promotions. Reminder is given of this neglect of criticism by the appearance of the prospectus of another Company—Cambrian Anthracite, Limited, of which Sir George is also Chairman. If Sir George goes on increasing his directorial engagements at this rate, he will soon find his time very fully occupied. The Anthracite Company is not much in our line—except that anthracite is a useful commodity for suction-gas producer plants, and for enclosed stoves which are not very effectual opponents of gas-fires. The already issued capital of the "new" concern is £30,000. It appears from the prospectus that the Company was registered in 1909, mainly to acquire the Saron Collieries. But the prospectus does not say anything about what has happened during the past five years, nor anything as to the finances of that period. Now it is proposed to issue £30,000 of 7 per cent. first mortgage debentures at 92½ per cent. The promise of 7 per cent. for a first mortgate debenture, with 7½ per cent. discount from the nominal value, is not a recommendation. Besides it is noticed that, if the applicants for the debentures chose to pay the purchase money in full, they may deduct a further 4 per cent. The "Financial News" is not at all satisfied with the prospectus. It says: "A Company registered in December, 1909, should have set forth its profits since that date. In the absence of any statement, its debentures should be avoided." It also seems that of the money it is now proposed to raise, £15,000 is required for equipment. But, in speaking in the prospectus of the acquisition of the Saron Collieries, machinery is referred to as forming part of the property purchased. Is not this machinery sufficient without spending more money, or has it fallen into a bad state during the past five years' history of the concern, which history appears to be sheathed against inquisitive persons?

The Past Year at Bradford.

The experience of those who have charge of the Bradford Corporation gas undertaking has during the past financial year been the same as that of those connected with the great majority of the gas-works of the country. As Mr. Charles Wood puts it, owing to the extortionate prices demanded for coal, the fall in the values of residuals, and the increasing cost of labour and materials, the period referred to has been an exceedingly trying one for all gas undertakings. For the previous year at Bradford there was a profit of nearly £20,000; but this was a record, the general policy adopted by the Committee for some years having been to sell gas at very little above cost price. On the present occasion there falls to be recorded a loss of £860; but this has been occasioned solely by the matters already alluded to, which it is beyond the power of the department to control. The working results of the undertaking, so far as they can be influenced by good management and loyal service, exhibit an all-round improvement. Heavy as the additional cost of coal is, it would have been still more but for the improved working of the vertical retorts in operation, by which there has been extracted more gas per ton of

coal. A specially gratifying feature of the report of the Engineer, which is noticed at length in another column, is the statement that a reduced charge for gas used in engines has resulted in an increase during the latter half of last year in the quantity consumed for this purpose of no less than 11½ per cent., as compared with the corresponding period of 1912. In the amount of gas sold for all purposes there was an increase of 1¾ per cent. It is evident that nothing at all is required at Bradford except a return to normal conditions; but this Mr. Wood thinks will not be yet awhile—for though it will be possible to buy coal a little cheaper, residuals are not promising at all well. When considering even the present report, however, it must always be remembered that the street lighting cost the department £10,000 more than the Finance Committee paid them.

One Per Cent.

Twelve months ago, at the meeting of the Urban District Councils' Association, a paper was read advocating the view that the profits of municipal undertakings allocated in relief of the rates should not exceed 1 per cent. per annum on the outstanding capital of the concern. The author was Mr. W. T. Postlethwaite, the Clerk to the Swinton and Pendlebury Urban District Council; and he associated with the paper a motion to the effect that, in the opinion of the conference, the profits allocated should not be more than the proportion named. The members, however, regarded the matter as being too big a one to be disposed of at once; and the author withdrew his motion, and agreed to submit another paper on the subject at the next meeting. Accordingly, the question was again introduced at last week's conference of the Association in London, and Mr. Postlethwaite enunciated the view that it was a wrong and a dangerous principle to regard municipal trading undertakings in the light of money-making concerns—relief to the rates being thus made the deciding factor when the adoption or otherwise of any enterprise was considered. He took the well-known annual statistics of Mr. James Carter, Borough Treasurer of Preston, to show the large sums paid by these undertakings in aid of the rates, and remarked that in this connection gas seemed to be a prime favourite. He concluded by submitting once more his resolution, and agreed to a suggestion that he should add a proviso that such rate of 1 per cent. "may be exceeded if and so far as may be necessary for the purpose of recouping any loss which may previously have been incurred in respect of such undertakings." He, however, confessed that he did not expect the resolution would be carried; and in this he proved correct, for it was rejected by a large majority. Nevertheless, objection is growing to the form of indirect taxation represented by the transfer of huge sums from trading undertakings in aid of the rates; and perhaps the time may come when even the Urban District Councils' Association will modify their present views.

Coal-Stove Makers on the Warpath.

In the "JOURNAL" for May 19 last (p. 487), under this heading, and the two succeeding ones, comment appeared on a couple of curious circulars for which Messrs. Smith and Wellstood, Limited, the well-known makers of coal-stoves, were responsible. The circulars were a luminous testimony to the fact that the firm are acutely feeling the transference of the coal-stove manufacturing business to the firms manufacturing gas cookers and fires, as well as the energy of the gas-supply industry in working for the displacement of air-polluting solid fuel, and the cessation of the barbarous destruction of valuable constituents of coal by the methods of heating for which Messrs. Smith and Wellstood, among many others, provide the necessary appliances. In one of the circulars, the retail coal merchants were urged to send round a leaflet which the firm had prepared containing stupid references to gas (the gist of this was given in our issue on the date named), in order to stem the flowing tide of the gas-stove, and to advertise the pre-eminent merits of the Smith and Wellstood coal range. But it appears that the response of the coal merchants did not equal the provision of leaflets made by the firm, for they say, in a fresh circular just issued, that they "have still *large quantities* of the leaflets beside us; and we find we have received no application from your town"—this notwithstanding that the leaflets are free. The firm are therefore issuing fresh invitations for applications for the leaflets. In doing this, they say: "Gas companies as a whole are advertising the advantages of gas-heaters, gas-cookers, and gas water-heaters as superior to appliances burning coal. If you want to retain your trade, you must also impress the public with the advantages of using coal as against gas." The coal retailers will have something to do. Perhaps, by waiting a bit, they might obtain some guidance as to what they should say by reading the evidence that is being given before the Departmental Committee on the Smoke Nuisance.

The Revenue Bill, 1914.

The attention of all occupiers, as well as owners, whether private individuals or companies, is called by the Land Union to the expense, trouble, and inconvenience with which they are threatened by clause 1 and schedule 1 of the Revenue Bill just introduced by the Chancellor of the Exchequer. It is pointed out that, under the pretext of enabling the Commissioners of Inland Revenue to obtain information for the purposes of the Government's undisclosed proposals, the Bill imposes on all owners and occupiers of agricultural land and of buildings, shops, factories, docks, gas-works, water-works, and all other commercial undertakings, "the costly and oppressive burden of submitting to a written cross-examination far more difficult than the notorious Form IV."—the penalty for a default being a fine not exceeding £50. Among numerous other details, particulars will have to be furnished of all improvements (which word expressly includes buildings, plant, and machinery) executed within the last fifty years. The Union remark that in the case of gas-works, water-works, factories, and other places where costly and special machinery and apparatus are used, the task imposed would be most oppressive—valuations and estimates being required of (1) the unexhausted value due to the erection of buildings and of any alterations or additions thereto, and (2) the unexhausted value due to the fixed plant and machinery. Proprietors of gas, water, electricity, and other works will, it is said, have to render particulars of receipts and working expenses. There are many other objections to the measure set forth in the documents issued by the Union; and those who desire fuller information on the matter should communicate with the Secretary, Mr. C. H. Kenderdine, at St. Stephen's House, Westminster, S.W.

We greatly regret to have to announce the death yesterday, at Broomhill, Witley, Surrey, aged 67, of Mr. JOHN HORSLEY PALMER, whose resignation of the offices of Director of the Imperial Continental Gas Association and the British Gaslight Company was referred to in last week's "JOURNAL." The funeral will be at Witley Church on Thursday, at 3 o'clock.

PERSONAL.

It has been announced that Dr. SAMUEL RIDEAL, whose name and position as an analytical chemist are known to most of our readers, is the accepted candidate to represent Salisbury in Parliament in the Liberal interest.

Mr. B. R. GREEN (the late Engineer of the Mitcham and Wimbledon Gas Company, and now on the Board of the Wandsworth, Wimbledon, and Epsom District Gas Company) has been elected to the vacancy on the directorate of the South Suburban Gas Company, which has never been filled up since the death of Mr. Robert Morton in 1911.

Mr. F. M. RUGGLES, younger son of the late Mr. C. F. Ruggles, of Leighton Buzzard, has been appointed Manager of the St. John's Gas Light Company, Newfoundland. Mr. Ruggles obtained the position of Assistant-Manager about three years ago; and on the resignation of the Manager last month, on account of ill-health, he was entrusted with the more responsible duties. He was educated at Berkhamsted Grammar School, and was Assistant first to his father and subsequently at Felixstowe.

Gas Light and Coke Company's Dividend.

We are informed by the Secretary of the Gas Light and Coke Company (Mr. Henry Rayner) that the accounts of the Company for the past half year show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 17s. 4d. per cent. per annum; carrying forward to the next account the sum of £535,314 1s. 4d. The dividend for the first half of the past and of the preceding year was at the same rate, with a balance of £710,551 15s. 8d. for the former and of £768,407 18s. 2d. for the latter period.

PRESENTATION TO THE LATE CHAIRMAN OF THE SULPHATE OF AMMONIA COMMITTEE.

ELECTED a member of the Executive Committee of the Sulphate of Ammonia Committee in July, 1903, and Deputy-Chairman in July, 1904, Mr. Thomas Milne, of the Residuals Sales Department of the Gas Light and Coke Company, was appointed Chairman of the Committee, on the retirement of Mr. W. G. Blagden, in July, 1910. Since then, as we have known from observation, and as his colleagues confirm, he has devoted himself, and his extensive knowledge, unsparingly to the purely voluntary work to which he had put his hand. But in the spring of this year, his health was not up to its normal state; and he felt that, with the burden of his ordinary responsible work, the time had arrived when he ought to seek relief from the duties entailed by the chairmanship of the Committee. This was a matter of the deepest regret to all his colleagues; and in accepting the resignation, and in inviting Mr. D. Milne Watson, the General Manager of the Gas Light and Coke Company, to succeed to the chairmanship (to which invitation he most willingly acceded), the Committee also prevailed upon Mr. Milne to continue to give them the advantage of his services as an ordinary member of the Committee. At the same time, the members of the Executive Committee determined to mark Mr. Milne's long and invaluable services in the chair by a presentation; and, for this purpose, they subscribed among themselves a sum of money amounting to about £150. Consulted as to the form the presentation should take, Mr. Milne selected various articles to adorn his house. But it was noticed that he had not chosen anything of a truly personal nature; and as there was a sum of £25 remaining from the amount subscribed, at last Friday's meeting of the Committee, this was handed to Mr. Milne, with a strict injunction that he was to purchase with it a suitable personal souvenir of his chairmanship. To Mr. John Fyfe, of Young's Paraffin Light and Mineral Oil Company, Limited, was deputed the pleasurable task of making the presentation; and he discharged the duty with characteristic geniality and wit. In fact, Mr. Fyfe made a happy occasion still happier by the life and humour of his speech, and the thoroughly deserved recognition of Mr. Milne's services to the Committee. What he said was enthusiastically endorsed by those present; and all this good spirit, hearty goodwill, and recognition, paved the way to a feeling acknowledgment on the part of Mr. Milne.

THE LATE MR. EDWARD STEARS.

A Link with the Past of the Gas Industry.

THE few lines appearing under the "Obituary" heading in the last number of the "JOURNAL," announcing the death of Mr. Edward Stears, of Lisburn, and of his brother, Mr. John Stears, of Hull—both at advanced ages, and within a day of each other—while recording the long connection of the former with the Lisburn Gas Company, did not show how closely the brothers and their father had been associated with the development of the gas industry in this country and abroad. It may therefore be of interest to present a few facts bearing upon the matter.

The late Mr. Edward Stears was a partner with his father in the firm of William M. Stears and Son (subsequently Stears Bros. and Co.), having in 1832 offices in Broad Street, London, and also at Hull, from which they carried on an extensive business in the designing, erection, and completion of gas-works all over the country. Records are extant proving the building and equipment by them of no less than forty-one gas-works in England and Ireland, where gas was used for the first time. Mr. John Stears (brother of Mr. W. M. Stears) erected and owned a number of gas-works in France, some of which are still in the hands of this branch of the family. That the work of the firm gave great satisfaction is shown by the number of testimonials sent to them. In the case of the Gloucester New Gas Company, the services rendered by Mr. W. M. Stears, for which he declined to accept any remuneration, were acknowledged by the presentation of a piece of plate. One of the French towns lighted was Versailles, the Mayor of which sent his personal testimony to the manner in which the contract had been carried out; the work having, he said, been done "with a success and exactitude worthy of all praise." The lighting was stated to be perfect.

It is interesting, at this distance of time, to read the prospectuses issued in connection with early proposals to introduce gas. Some of these are now before us. In the autumn of 1841, the townspeople of Hythe were invited to co-operate with certain promoters in the formation of a company with a capital of £2000, in £10 shares, for the erection of works and the supply of gas to the town. It was pointed out that the rivalry of Folkestone and the race of improvement she was running with Hythe were "such as ought to excite in the latter town the same honourable steps of emulation." Then the advantages to a town resulting from the introduction of gas were enumerated, one being the material aid it afforded to the police. The absolute security of gas shares as investments was emphasized; and the announcement was made that "a gas engineer of considerable experience, and connections with similar undertakings in the western and northern counties of England, finding a feeling so strong in favour of gas, with the probability of its becoming the universal mode of lighting, had, on his own responsibility, offered to erect works to light the town, provided the privilege of breaking-up the streets was secured to him, so that the works and apparatus might proceed without obstruction." Among the Directors was Mr. W. M. Stears.

Ten years later—in the summer of 1851, when the popularity of the Great Exhibition was at its height—the prospectus was issued of the Sydenham Gas and Coke Company, with a capital of £3000 in £10 shares. It was remarked, at the outset, that Sydenham, with its surrounding district, afforded attraction and delightful scenery worthy of that increase in its population and trade which would inevitably accrue to it from the very close communication it enjoyed with the Metropolis; and it was suggested that the announcement of a gas establishment would, no doubt, be "hailed with pleasure by everyone interested in property, or desirous of adding comfort to himself or family." The general concurrence of the town in the proposition for the erection of gas-works was evinced by the number and character of the signatures to a memorial to the Board of Surveyors requesting authority for the contractor to open the streets to lay mains. This permission had been granted. The contractor, while anxious that the concern might be "managed in the manner most satisfactory to the consumers of gas," expressed his willingness to lease the works for ten years, guaranteeing to the proprietors interest at the rate of 5 per cent. on their capital for the first five years, and 6 per cent. for the second five, and supply gas to private lights on the following terms per 1000 cubic feet: Up to 300 lights, at 10s.; from 300 to 500 lights, at 9s.; from 500 to 750 lights, at 8s.; from 750 to 1000 lights, at 7s.; and proportionately for a greater number of lights, with a discount of 10 per cent. on all quarterly accounts amounting to £10 and upwards. It is scarcely necessary to add that the contractor was Mr. W. M. Stears, who was one of the Directors of the Company and was then described as of Hull and Sydenham.

Special interest attaches to the prospectus of the Clevedon Gas Company, Limited, issued in May, 1856; the proposed capital being £3500 in £10 shares. The townspeople had generally concurred in the proposition for the erection of gas-works, and promises of patronage and support had been forthcoming. The Local Board of Health had expressed their approval, and granted the necessary permission to open the streets for the laying of mains. Reference was made in the prospectus to the fact that the new Limited Liability Act, under which the Company was to be formed, prevented any responsibility beyond the amount of shares subscribed for, so that hesitating individuals might join with full confidence. With the view of affording an excellent reason for the adoption of gas for private lighting, the compilers of the prospectus called attention to the "wonderful success attending the recent introduction of gas, upon a magnificent scale, for lighting the new ball-room and galleries at Buckingham Palace," which had been "lighted by upwards of 7000 burners, to the delight of Her Majesty, with unqualified success." This result, it was submitted, would give the best guarantee for the introduction of gas generally for the lighting of the mansions and other private residences of the inhabitants of Clevedon. The Company's Engineers were Messrs. Stears and Son, of Moorgate Street.

To return to the late Mr. Edward Stears, shortly after the death of his father, and in consequence of the state of his health, he accepted for a short time the position of Manager of the Lisburn Gas-Works, but eventually decided to settle down there. He retired about seven-and-a-half years ago. He did not take any part in public affairs. He leaves a family of two sons and three daughters; his wife having died seven years ago.

An International Municipal Conference.—During the present week, a conference is being held at the Anglo-American Exhibition, Shepherd's Bush, at which the mayors of some of the most important cities of the United States and the United Kingdom, with a large number of other gentlemen interested in municipal self-government, are expected to be present. Viscount Peel, the Chairman of the London County Council, is President, and many local administration subjects are to be discussed. The conference is sitting between 10 a.m. and 5 p.m., until the 25th inst.

Temperature Distribution in Coke-Ovens.—In a recent issue of "Stahl und Eisen" [No. 34 of 1914], this subject was dealt with by Herr O. Simmersbach; and his article was abstracted in the number of the "Journal of the Society of Chemical Industry" for the 15th inst. The temperatures in a Koppers oven were recorded every 12 minutes by pyrometers placed at three points along the axis of the oven, 3 ft. 3 in. above the sole, and also at three corresponding points in the free space above the coal. The period of coking was 29 hours. The temperature increased most rapidly, and was finally highest, at the narrower charging end. The temperatures in the gas space above the coke did not change in the same way as those within the mass of coke at the corresponding points, but depended on the position of the gas outlet. Samples of gas were taken every two hours. The proportion of carbon dioxide decreased from 3·3 to 1 per cent. in 19 hours, and then became nearly constant; benzene decreased from 1·8 per cent. to zero in 17 hours; ethylene fell from 4 to 0·3 per cent. and methane from 36·65 to 4·7 per cent. during the whole period; while carbon monoxide increased from 0·9 to 5·8 per cent. and hydrogen from 42·5 to 70 per cent. The heating value decreased from 5402 to 2419 calories per cubic metre (600 to 270 B.Th.U. per cubic foot).

ELECTRICITY SUPPLY MEMORANDA.

It seems that the makers of the lamps erroneously styled the "half watt" are not prepared to accept the verdict of the investigations made at the time the high-power units were evolved, as to the physical impossibility of making low-power units of an equivalent efficiency. The difficulty in applying the principles of the nitrogen filled lamp to lower power units was one of temperature; it being found that the loss by convection from the extremely fine filaments needed for low-power units was a bar to realization. Since then we have time after time been told that the best brains and hands are engaged in the laboratories trying to discover means for riding victoriously over the physical disabilities. If anyone is in a position to know what is happening, it should be Mr. Hugo Hirst, the Chairman of the General Electric Company, Limited, who possess the sole rights in the Osram lamp in the British Empire. His words are thought by some to be optimistic as to an ultimate conquest. But they strike us as being of that indefinite kind, which shows a preference for sitting on the fence, with a leg dangling either side. Addressing the shareholders of the General Electric Company, he stated that a "satisfactory" business was being done in the half-watt high-power lamps. Then (quoting from one report) he proceeded to say: "What further surprises were in store through development in this direction, he did not care to predict; but partly from what he saw and partly intuitively, he felt these surprises were very close ahead." These words are beautifully vague, equally stimulative, and, at the same time, they offer splendid cover for Mr. Hirst in the event of the low-power half-watt lamp taking the wrong turning. This gentleman's words, however, have put confidence in one electrical journalist to such a degree that he takes upon himself the duty of warning those central station engineers whose tariffs are not adapted to the spread of still higher efficiency lamps that they will have an unpleasant awakening. When this low-power (so-styled) half-watt lamp comes along, will it be for current voltages, or for working in series, or with transformers?

Half-Watt Hopes.

The "Elektrotechnische Zeitschrift" has published an account of the results of some experiments on half-watt lamps carried out by Dr. Lux; and the "Electrical Review" refers to the results as indicating that, though the half-watt lamp offers great advantages over the ordinary tungsten lamp, it does not represent a radical advance in the efficiency of light production. Using Wien's equation, Dr. Lux concludes that the filament temperature of a 1000-candle power 110-volt "Nitra" half-watt lamp is 2850° C. absolute, as compared with 2450° C. absolute, the filament temperature of a 200-candle power 110-volt Osram lamp. Respecting spherical candle power per watt, the ordinary tungsten lamp is superior to the half-watt type. At 2400° C., for instance, the former yields 0·76 spherical hefner per watt, and the latter only 0·64 spherical hefner per watt—*i.e.*, 18·75 per cent. less light for a given power input. Owing to its nitrogen filling, the half-watt lamp reaches an efficiency which is high, but lower than that obtainable were it possible to run the filament of an evacuated lamp at the same temperature. Under normal full-load conditions in the half-watt lamp, some 8 per cent. of the total radiated energy, but only 4·8 per cent. of the energy supplied, is available as light; the discrepancy being due to the considerable loss of energy by conduction and the loss of light within the tightly wound spiral itself. Loss by conduction is considerably greater than in evacuated lamps. No considerable further improvement can be anticipated in the efficiency of tungsten lamps; the efficiency being 1 spherical hefner per 0·3 watt when the filament temperature reaches the melting-point (3200° C. absolute) of tungsten. These tests remove the lamps further than other investigators have placed them from justification to the title of "half-watts."

Lux on Half-Watt Lamp Efficiency.

Sir Howell Davies has performed his annual duty of presenting, for first reading, the Electric Supply Bill promoted by the Municipal Electrical Association. This good-natured act graced the day of June 30; last year, of June 4; and the year before, of May 7. These dates show that Sir Howell gets later and later each session in performing the kindly function. At any rate, the dates named are the ones on which the Bill has been "ordered by the House of Commons to be printed," and more money wasted on the formality of the printing. What on earth is the good of presenting the Bill at this time of the year, with the session within a few weeks of its end, the Government dreadfully tired, and the members of the House utterly sick of the general condition of affairs, even on the Ministerial side? The measure, as introduced, is precisely in the same form as last year; so that all the negotiations, all the exquisitely childish revision of the text that took place earlier in the year, have come to naught, and all through the recalcitrant contractors, who seem to be in a stronger position than the promoters of the measure. It was boasted recently that the promoters are securing a larger and larger adherence in the two Houses of Parliament; but it was an amazing confession that the Hon. Secretary of the Municipal Electrical Association made the other week when he said that the result of the appeal for the support of members of Parliament in obtaining a place for the Bill was "two or three promises." That is a very bad sign; and another is that only the other day it was stated during the proceedings on a Bill before one of the Parliamentary Committees that the practice of the House is now to keep a tighter hold upon municipal finance. But the Municipal Electrical Association are out for freedom, and such freedom as they are not likely to get. Probably they have opened their mouths widely, in order to allow a good margin for a reduction. Mr. Frederick Hall appears to have a little sympathy with municipal electrical concerns, for he was asking the other day in the House whether showroom and other powers possessed by municipal gas authorities were denied to municipal electricity undertakings. We have not observed an answer to this question; and so it looks as though Mr. Hall has not pressed it, or perhaps a verbal answer has been given which was not recorded. But the electrical industry might notice that the current model piping and fittings clauses for municipal gas undertakings are precisely the same as those allowed to municipal electricity concerns, so that there is nothing to choose between them now. The experience of the Municipal Electrical Association, in appealing for parliamentary support, and the knowledge of the large following that the electrical contractors possess in both Houses—there being a very considerable defence in each of private enterprise as against municipal adventure—must make the promoters of the Bill feel heartily sick. We take it the funds that were subscribed for the purpose of promoting the Bill have a fresh incision made in them as session follows session.

The Unfortunate's Annual Airing.

The "Eclipse" electric-cooker is everything that could possibly be desired—at least, so we gather from the pamphlets that are issued by the makers, the Electric and Ordnance Accessories Company, Limited. There is with them no dust, dirt, fumes, and odours, which are inseparable from all forms of cooking other than electrical; the food is not contaminated with gases, odours, and dirt; the economy is greater; there is less shrinkage, and the full flavour and juices of the food are retained; there is no danger from shock, as the "heating elements are guaranteed;" there is no fear of breakdown; there are no weak points anywhere in the "Eclipse;" and efficiency?—well, it is of the 100 per cent. order, seeing that "as all the energy used, which must be paid for, is transformed into useful heat, there is no waste. The efficiency of gas-cookers and coal ranges is very low, as a great amount of heat produced by them is allowed to escape." This is a summary of the cheap-jack form of advertising composition found in one of the pamphlets, in which the Electric and Ordnance Accessories Company quite equal, if they do not eclipse, their competitors. It is all laid on much too thickly to please or capture even the man in the street. The other pamphlet is nearly as bad. We see from a covering letter that the prices quoted in the pamphlets are subject to a 10 per cent. advance; and electricity concerns are allowed the firm's "best" trade discount of 33⅓ per cent. This must be remembered in noting the prices charged for the cookers, because the makers lay it down as an acceptable proposition that the question of obtaining absolutely satisfactory results with electric-cookers is of far greater importance than the initial cost of the cooker. There is wisdom in this statement. The "Eclipse" domestic cooker has an oven with an internal measurement of 23 in. high, 13½ in. wide, and 13½ in. deep; and the over-all dimensions are 34 in. high, 24½ in. wide, and 23 in. deep. The hourly rating is: Oven, 2400 watts; two 7¼-inch hot-plates, 1900 watts (the two); and combined grill and hot-plate, 1000 watts—a total of 5300 watts. This outfit complete is priced at £12 10s.; or the oven only can be had at £7; and the top as a breakfast cooker at £6 10s.—all less 33⅓ per cent., and *plus* the 10 per cent. advance. If a boarding-house keeper wants an "Eclipse," he or she can have one with an oven having an internal measurement of 22 in. by 26¾ in. by 22 in., with four 7¼-inch hot-plates and two 5-inch ones, and a combined grill and hot-plate. The ratings are: Oven, 4800 watts; four hot-plates, 3800 watts; two, 800 watts; and combined grill and hot-plate, 2000 watts—together 11,400 watts. This complete cooker is priced at £45. We may be certain that there will not be many "Eclipse" cookers let out on hire by electricity undertakings in this country at a paying rental—including sinking fund, interest, depreciation, and maintenance.

All Else Eclipsed.

The "Electrical Times" has been paying a large amount of attention to the electric vehicle; and it quotes Mr. R. A. Chattock, City Electrical Engineer of Birmingham, as saying that the electric vehicle business is going to be a bigger thing for the electricity supply industry even than electric cooking. This is quite possible. But it comes almost as a surprise that "Meteor," who is an inveterate economist in acknowledging that gas has any strength left as a competitor, should make even this characteristically worded confession: "Cooking has this defect—the ground must be disputed inch by inch against a ferocious competitor. The price must be very low indeed if that competitor is to be ousted." The amount of ferocity that there is in the gas competitor is illustrated by the fact that, save in rare cases, the charges for gas used for cooking and heating are the same as the lighting rates. As the preceding paragraph shows, it is not only the charge for gas that makes the competition severe for electric cooking, but the cost of the cookers; and to this may be added

Hedging by the "E.T."

installation, maintenance, and inspection. In another part of the "Electrical Times," there is a reference to an incidental remark by Mr. J. H. Bowden, in his annual report on the working of the Electricity Department of the Poplar Borough Council. Mr. Bowden has personally a magnificent outlook. "Some idea," he says, "of the immense possibilities of the cooking load may be derived from the fact that 3000 units used by a family not exceeding five persons is a fairly moderate estimate, which would yield 600 units per head of population." The "Electrical Times" does not agree that this is a "moderate estimate," and inclines to the belief that it will not be reached unless some amount of electric heating be done. It adds: "Experience of hundreds of cooking installations indicates that the consumption averages just over 1 kelvin per day per person, or (say) 400 annually. Mr. Bowden expects the consumption to reach 600 per person. Deducting the lighting consumption—say 200 kelvins for the year, or 40 per person in a household of five—this would leave 560 kelvins per person from the cooking apparatus alone, which works out at 1·53 kelvins per person per day, a somewhat liberal allowance, which might be justified with the low rates available at Poplar, but would be prohibitive in less progressive districts. It is a curious idea to take averages for lighting and cooking per person in this way, and to adopt them as a standard for calculations, seeing that for both purposes in a household it must follow that the averages ar ‹higher as the number of the members of a household gets lower, and smaller as the number gets larger. And the conditions in households are as varied as the pebbles on the seashore. Anyway the "Electrical Times" seems now to have gained with experience new impressions, and to be hedging itself against its old-time visions as to the immediate desolation of the gas industry in the cooking and heating fields.

Poplar's Output Jump.

Speaking of Mr. Bowden's report, we must congratulate him upon the excellent showing that he made for Poplar last financial year. The total number of units sold was 16,716,705; being an increase of 4,701,911, or 39·13 per cent. The net income from the sale of current was £67,647, or an increase of £11,459, being equal to 20·4 per cent. The net profit over the whole undertaking was £8010, a portion of which surplus (amounting to £5884, and including £967, cost of wiring installations, and £91, cost of cooking installations!) he applies to a large number of charges. The unappropriated balance (including £2691 brought forward) is £4817. It is rather interesting to see whence the increase in consumption came; and it is found, as would be expected in this industrial area, that the greater part of it issued from power custom and the new supply-in-bulk to the Stepney Borough Council. These are the actual figures:

	1912-13. Units.		1913-14. Units.	Units.
Private lighting . .	1,026,542	..	1,098,860 +	72,318
Domestic	440,122	..	746,736 +	306,614
Power	9,572,902	..	11,284,056 +	1,711,154
Bulk	158,152	..	2,665,135 +	2,506,983
Public.	817,076	..	921,918 +	104,842
Total	12,014,794	..	16,716,705 +	4,701,911

Of the total consumption, only 1,845,596 units were consumed for private lighting and domestic supply, realizing £18,887; while the balance of nearly 15 million units—about eight times more—only realized £48,760. In other words, the private business produced nearly £10,000 per million units and the other business a little over £3000 per million. Of the private lighting there were 716,549 units sold at 5d., 4d., and 3d. per unit, and realized £10,852; while under domestic supply, with fixed charges and ½d. per unit, 746,736 units were sold (about the same number) for £5862—£5000 less. The balance of the units sold for private lighting were at 2½d., 2d., and per agreement. Of the power units 1,235,556 were sold at 1½d., and 10,048,500 per agreement—prices not divulged. The bulk supply was at 0·25d., and public lighting was charged at ½d. We do not think (we have not details at hand with which to make a proper calculation) the department could well afford on the present accounts to lose *en bloc* its 5d., 4d., and 3d. lighting consumers to the fixed charge and ½d. per unit supply. "On the present accounts." Of course, coal has been at an exceptional price; and in normal times the department could perhaps better afford the change. But times are not always normal; and the average receipt per unit shows a persistent declining tendency, with the cheaper units ascending in demand, and the dearer ones not so much in request. Taking the whole of the private lighting, the average price obtained for it was 2·845d.; and for domestic supply on the fixed charge and ½d. per unit rate 1·884d. The average price obtained over the whole supply last year was 0·151d. less per unit. The working costs, however, do not exceed 0·55d. per unit sold, which constitutes a record for the Metropolitan area. The 0·55d. notwithstanding, Mr. Bowden now recommends the reduction of the charge for public lighting from 0·5d. per unit to 0·4d.—while the greater part of the revenue from private lighting is at 3d., 4d., and 5d. per unit! The average price at which energy was sold was 0·97d. per unit, or, deducting the bulk supply to Stepney, 1·11d. The 5d., 4d., and 3d. lighting consumers came in handily in realizing this average; for the 14,871,109 units sold outside lighting and domestic supply only realized an average of rather under 0·79d. We do not see any depreciation account among the several accompanying the report; and the contingency reserve possesses a balance of midget order —£944! But there is an unappropriated revenue balance of £4817. The accounts, taken as a whole, are something of which Mr. Bowden may be proud; but he is lucky in having an exceptional industrial area.

PUBLIC LIGHTING OF PARIS.

Electric Lamps and their Cost Compared with High-Pressure Gas Lighting.

We have already [see *ante*, p. 91] dealt with two of the three articles of the series on the public lighting of Paris which M. André Grebel lately contributed to the "Génie Civil." It only remains to notice the final article, and give the conclusions to which his investigations have led him.

He takes up first the subject of high-power incandescent electric lamps and explains their arrangements and capacities. He gives an illustration of the "Nitra" tungsten filament lamp, the specific consumption of which he says is 0·5 watt per horizontal and 0·65 watt per mean spherical candle for the naked light. The durability of the lamp is 800 hours, in which period its luminous intensity falls off to the extent of about 17 per cent. Its average consumption per spherical candle is really, for the present, 0·75 watt. With the aid of a reflector, it is possible to modify advantageously, for public lighting purposes, the distribution of the luminous intensity of the naked lamp. In comparison with the results of the trials of other metallic filament lamps, M. Grebel says it might be admitted that, with a suitable reflector and a clear globe, the consumption could drop from 0·75 watt per spherical candle to 0·51 watt per lower hemispherical candle. But if, in order to diminish slightly its excessive brightness, the lamp is surrounded with an opaline globe absorbing only 8 per per cent. of the light, the consumption rises to 0·55 watt. The author explains that his calculations in regard to cost will be based upon the naked light.

M. Grebel passes on to deal with the cost of public lighting in Paris by means of intensive electric incandescent lamps. He acknowledges that it is rather premature to make an estimate, failing sufficient experience of the new lamps and of numerous laboratory tests. However, the lighting of the port of St. Nazaire has already been carried out by "Nitra" lamps of 2000-candle power, and part of the public lighting of Rennes by others of 600 and 1000 candles. A considerable number of trials of the lamp are in progress by railway companies, the proprietors of large warehouses, and others. M. Grebel considers that the fixed maintenance charges, which are much lower than in the case of the flame arc lamp or of high-pressure gas, would not exceed 25c. per day. He estimates the annual cost of a lamp of 1960 effective candle power at 1326 frs. 55c. The number of candle-hours furnished by this lamp per annum, with 3762 kilowatt-hours' consumption of current, would be 7,376,500, reckoning 0·51 watt per lower hemispherical candle power. The net cost per candle-hour would thus be (132,655 ÷ 7,376,000) 0·0179 c., or 67·6 c. per candle-year.

M. Grebel then proceeds to compare the cost of the three systems he has been considering. Taking only the expenses of current and gas, at the prices paid by private consumers in Paris, he arrives at the following results: High-pressure gas, 0·014 c. per lower hemispherical candle-hour; arc electric light by enclosed mineralized carbons, 0·015 c.; half-watt incandescent lamps, 0·0255 c. He points out, however, that to these figures must be added various accessory costs, and that since the reduction has been made in the price of current and new flame arc lamps have been introduced, the advantage from a strictly economic standpoint no longer belongs exclusively to high-pressure gas. At the same time, the net costs would decrease slightly for high-pressure lamps if they gave the same lighting both after and before midnight, like arc lamps. The cost of these lamps per candle-hour would then be very near that of the alternate-current arc lamp—the figures being respectively 0·0147 c. and 0·0133 c. for lamps of 714 and 3128 candles respectively.

The author next deals with the brilliancy of the light sources, the colour of the light, the stability of the luminous intensity and the constancy of the yield, the distribution of the illuminating power, and the simplicity of maintenance. He then takes up the subject of low-pressure inverted gas-lamps. He says the advantage attending these lamps is that they yield almost the whole of their luminosity in the lower hemisphere, which is an interesting point in the case of public lighting. They have been tried on a large scale in Paris, where there were in use, at the time that M. Grebel prepared his articles, 1184 units, consuming from 10 to 31 cubic feet of gas per hour. Large low-pressure inverted burners have been produced of which the hourly consumption is 6·3 cubic feet of gas per mantle, with good yields. Some trials carried out in the laboratory of the Conservatoire des Arts et Métiers gave 0·027 cubic foot per lower hemispherical candle-hour with a new single-burner Auer lamp, at a pressure of 20-10ths. With a triple-burner Graetzin lamp of 600 candles, there was found a specific consumption of 0·26 cubic foot per hemispherical carcel, measured in the meridian where the horizontal intensity is greatest. With a similar lamp of 1000 candles, the consumption was 0·21 cubic foot at a pressure of 28-10ths. When reckoning a ratio of maximum to mean intensity of 86 : 70, the figure for consumption

corresponds, for the mean, to 0·027 cubic foot per lower hemispherical candle power. At the time when M. Grebel wrote his articles, there were in use in Paris 28 three-burner inverted lamps. He says these modern inverted burners do not furnish a better yield than the modern upright burners, which give a spherical candle-hour with a consumption of less than a litre (0·0353 cubic foot) of gas, and which, when provided with a flat reflector, give a lower hemispherical candle-hour with less than 0·7 litre. However, at pressures higher than 20-10ths, inverted burners work well when the specific gravity and the "comburivorous power" of the gas do not vary too much. With the exception of the single-burner lamp recently produced by the French Auer Company, all those fitted with low-pressure inverted burners are of German origin.

M. Grebel next gives some figures showing the development of high-pressure gas lighting in Paris up to the close of last year. They were reproduced in the "JOURNAL" for the 16th ult.; and some supplementary figures relating to the Keith system were given in the following number (p. 970). He comes to the conclusion, from the statistics he has published in the course of his articles, that gas conserves a very great supremacy in the public lighting of Paris. Comparing the candle-years actually produced, the enclosed mineralized carbon arc, with continuous current, seems to possess a slight advantage, which M. Grebel thinks is very largely discounted by the defects of its light. The new high-power electric incandescent lamps can possibly be perfected, in regard to yield and durability, and their selling price will doubtless be reduced. When this is done, their entrance into competition with electric arc and high-pressure incandescent gas lighting may, he considers, be looked for.

WORKS TOPICS.

By "Modus Operandi."

CALORIFIC VALUES AND OVER-EXHAUSTION.

THERE are some points in Mr. Herring's letter in the "JOURNAL" for July 7 (p. 36), on calorific values, which merit close consideration by those responsible for the quality of gas supplied by gas undertakings. Whether or not it is possible to fix any definite ratio between candles and calories is very uncertain, and, personally, I should consider that, even if the records of the past showed a fairly conclusive relationship between the illuminating and the heating value of the gas supplied in those districts where both systems of testing have been in vogue, there would be a strong tendency, where a calorific standard only is imposed, for the factor—British thermal units per candle—to increase much beyond past figures. If 37 B.Th.U. per candle of illumination represents past records, surely when coal is being carbonized for heating value solely the amount of concentrated attention that this subject will then receive will disclose many important points for increasing calorific values and reducing the virtually unimportant illuminating value.

Past history has shown that not until a change in standard actually comes into force do new methods of working receive any real consideration. The institution of the No. 2 "Metropolitan" burner immediately resulted in immense increases in the make of gas per ton of coal. Many new ideas which had been impossible of realization under the old *régime* became practicable under the new. Concentration of attention disclosed new means of taking full advantage of the new standard. So it will be with the new calorific standard.

At the present time most engineers are extracting between 6,500,000 and 8,000,000 B.Th.U. (gross) from a ton of coal in the form of gas. When it becomes all-important to produce the maximum quantity possible of British thermal units per ton of coal, this figure will undoubtedly increase as the result of concentrated experience by scores of trained minds all working on the same subject. Therefore if any factor of British thermal units per candle be settled at this stage, I venture to prophesy that it will have to be greatly increased in years to come.

Mr. Herring's remarks on the quantity of non-combustible gas which may be found in the gas supplied in various districts should serve to draw attention to a point which should be taken in hand by those responsible. In any case the quantity of nitrogen, carbon dioxide, and oxygen in the gas supplied should be known to every responsible head of a gas undertaking. Too many are content to work to an illuminating power standard without paying any regard to the other important properties of the gas they are supplying. Every chief should be in a position to examine daily, or at least weekly, the average, together with maximum and minimum, illuminating power, calorific power, and the percentage total of non-combustible gas supplied. The British thermal units produced per ton of coal is another figure which should always be recorded. No better means of obtaining average figures can be adopted than that in which a small test holder is set to fill gradually with the gas as supplied to the district. This sample can then be tested on the photometer and calorimeter, and further be completely analyzed, which figures will then disclose all that should be known of the average quality of the gas. For maximum and minimum figures the value of recording calorimeters cannot be over-estimated.

There is no doubt that there is a good deal of justification for Mr. Herring's condemnation of increasing the quantity of non-combustible gas by over-exhaustion, which he appears to limit to "some of the larger companies." Why "larger," and why "companies?" What about corporations, who are their own judge and jury, and the smaller companies? The only difference lies in the fact that the larger companies are tested by independent examiners, while the others, especially corporations, are tested only by those responsible for the quality of the gas. The inference is obvious. A thorough investigation would most probably disclose the fact that the larger companies—which are, generally speaking, the only undertakings whose gas is regularly and independently tested by the municipal authorities—are supplying a more uniform and better quality of gas than those who are not independently tested and who are their own arbiters.

Though the fairness of Mr. Herring's statement, in which apparently over-exhaustion is limited to "some of the larger companies," is most emphatically disputed, there is no doubt that every gas engineer should pay particular attention to the limiting of the non-combustible proportion in the gas he supplies. It has always appeared to me that, having regard to the value of the coal which is carbonized in the lifetime of a retort, the expense of fitting up each retort to turn out the maximum quantity and quality of products from the coal is studied too closely. The efficiency in its working is sacrificed to the economy of its installation.

Let us consider for a moment the value of the coal carbonized per retort in a life of 1000 working days. Assuming that 24 cwt. of coal will be carbonized per retort per diem, it is seen that 1200 tons will in all be treated in each retort. Thus the value of the coal, which in its turn will yield products far in excess of its own value, is shown to be so vastly greater than the value of the retort which produces these results that surely a few extra pounds spent in fitting-up this retort to yield the maximum of results should not be begrudged.

The evil effects of over-exhaustion are largely caused by the necessity of treating all retorts, with charges, in different stages of carbonization, similarly as regards "pull" upon the outlet of the dip-pipe. On the inlet of the dip-pipe—that is to say, on the ascension pipe side—the "pull" or the pressure, as the case may be, is always in direct ratio to the quality and quantity of gas being evolved. It must be absolutely wrong to put a check on the retort that is giving off a high quality and quantity of gas, and likewise to pull on the retort which is throwing off a low quality and quantity of gas. But this is what is done in practice. This, of course, only applies to retorts worked with liquor seals. The arrangement is decidedly faulty; and it is most surprising that, in spite of this defect, horizontals with liquor seals are apparently yielding results equally as good as continuous verticals, where this fault is corrected.

If horizontals could be worked in such a way as to ensure that a steady and regular level gauge could be maintained in each retort, and that at the same time a liquor seal could be provided to overcome those difficulties of stopped ascension pipes and pitched hydraulics which are concomitant with the dry main, we should be well on the way towards greatly improving the yield and quality of good gas from horizontal retorts.

To enable this to be done, some system of governing the pressure in each retort is required. It will add to the expense of installation; but, as has already been shown, this is small in importance compared to the great value of the products yielded per retort. A little extra expense should be disregarded by those who study *pros* and *cons*.

Output of Calcium Carbide.—According to a French authority quoted by the "American Machinist," the world's output of calcium carbide last year exceeded 350,000 metric tons. The autogenous welding of metals requires a large quantity—about 22,000 tons being consumed for this purpose in Germany, as compared with 28,000 tons for illuminating. The price for calcium carbide in Europe was maintained at about $55 per ton. The production and price are regulated by a Syndicate, which at the end of 1913 was renewed for another term. The production of calcium cyanamide in 1913 was over 150,000 tons. The Odda works in Sweden has a plant capable of making 90,000 tons per annum. The production of calcium nitrate in Europe is between 100,000 and 120,000 metric tons.

Effect of Gas on Pianos and Organs.—According to a letter in the current "Bulletin" of the British Commercial Gas Association, attempts are being made to create prejudice against the use of gas in premises where pianos and organs are situated. A local agent of a firm of pianoforte makers complained of a gas-fire in a room in which there was a piano that had shown some defects, though three experts sent from London to investigate the matter did not attribute the faults to the cause stated. Another firm said "they made no choice between a coal-fire and a gas-fire of the most modern type." The writer of the letter emphasized the importance of raising or lowering very gradually the temperature of a room containing a piano, and said the door ought to be closed when the gas-fire is extinguished. Pianoforte show-rooms are kept at a temperature of 60° Fahr. "It is not to be wondered at, therefore," said the writer, "that high-class, sensitive instruments lose tone when transferred from these show-rooms to rooms which in many cases are slightly damp, and have only a few hours' heating in the week from a gas-fire. This amount of heating is not nearly sufficient in the months of heavy rainfall."

SULPHATE OF AMMONIA ASSOCIATION.

The Constitution of the Two New Committees.

[See Editorial Article on p. 147.]

In our leader columns to-day, there is a special article announcing the joining of the forces in one body of the Sulphate of Ammonia Committee and of the recently-formed Sulphate of Ammonia Manufacturers' Association. The new organization is to be known as the Sulphate of Ammonia Association; and the work is to be carried on quite separately by two Committees—the one the Selling Committee, and the other the Propaganda Committee.

Mr. D. Milne Watson, the General Manager of the Gas Light and Coke Company, has been elected Chairman of the new Association.

The constitutions of the Committees for the current year are as follows:

PROPAGANDA COMMITTEE.

Mr. D. Milne Watson (Chairman).

Mr. Jas. Blumer, Messrs. Bolckow, Vaughan, and Co., Ltd., Middlesbrough.
Messrs. Brunner, Mond, and Co., Ltd., Northwich.
Mr. Issac Carr, Widnes Corporation Gas Department.
Mr. Francis T. Cotton, Alliance and Dublin Consumers' Gas Company.
Mr. R. Dempster, Langlean Iron and Chemical Company, Ltd., Glasgow.
Mr. Wm. Dunsmore, Messrs. Wm. Baird and Co., Ltd., Glasgow.
Mr. Wm. Fraser, Pumpherston Oil Company, Ltd., Glasgow.
Mr. John Fyfe, Young's Paraffin Light and Mineral Oil Company, Ltd., Glasgow.
Mr. R. F. Gloag, Messrs. Sadler and Co., Ltd., Middlesbrough.
Mr. E. A. Harman, Huddersfield Corporation Gas Department.
Mr. W. R. Herring, Edinburgh and Leith Corporations' Gas Departments.
Mr. R. S. Hilton, Birmingham Corporation Gas Department.
Mr. Councillor W. Kay, J.P., Manchester Corporation Gas Department.
Mr. Wm. Love, Broxburn Oil Company, Ltd., Glasgow.
Mr. F. J. Mason, Birchenwood Colliery Company, Ltd., Stoke-on-Trent.
Mr. Thomas Milne, Gas Light and Coke Company.
Mr. G. C. Parnaby, South Metropolitan Gas Company.
Mr. James Paterson, Cheltenham Gas Company.
Mr. Lloyd Pease } of Messrs.
Mr. J. M. Horsley } Pease and Partners, Ltd., Darlington.
Mr. R. G. Perry, Messrs. Chance and Hunt, Ltd., Oldbury.
Mr. Alderman F. S. Phillips, J.P., Salford Corporation Gas Department.
Mr. H. Pooley, Leicester Corporation Gas Department.
Mr. A. Stanley, Simon-Carvès Bye-Product Coke-Oven Construction and Working Company, Ltd., Manchester.
Mr. R. M. Sutherland, Messrs. Jas. Ross and Co., Falkirk.
Mr. Hanbury Thomas, Sheffield United Gas Light Company.
Mr. Thos. Waddom, Newcastle-on-Tyne and Gateshead Gas Company.
Mr. Percy Ward, Bradford Corporation Gas Department.
Mr. John Wishart, Oakbank Oil Company, Ltd., Glasgow.

SELLING COMMITTEE.

District.	
No. 1 (SCOTLAND).	Mr. W. Fraser, Pumpherston Oil Company, Ltd. Mr. John Fyfe, Young's Paraffin Light and Mineral Oil Company, Ltd. Mr. William Love, Broxburn Oil Company, Ltd.
No. 2 (NEWCASTLE DISTRICT).	Mr. J. Blumer, Bolckow, Vaughan, and Company, Ltd. Mr. W. J. D. Burnyeat, Cumberland Coal Owners' Association. Mr. T. Waddom, Newcastle-on-Tyne and Gateshead Gas Company.
No. 3 (MANCHESTER DISTRICT).	Alderman F. S. Phillips, Salford Corporation Gas Department. Mr. A. Stanley, Simon-Carvès Bye-Pro-Product and Coke-Oven Construction and Working Company, Ltd. Mr. Richard Jones, Yorkshire Semet-Solvay Company, Ltd.
No. 4 (BIRMINGHAM DISTRICT).	Mr. R. S. Hilton, Birmingham Corporation Gas Department. Colonel Jackson, Clay Cross Colliery Company, Ltd. Mr. Emile Mond, South Staffordshire Mond Gas Company.
No. 5 (LONDON AND SOUTHERN DISTRICT).	Mr. G. C. Parnaby, South Metropolitan Gas Company. Mr. T. Milne, The Gas Light and Coke Company. Mr. J. R. H. Jacobs, Southampton Gas Light and Coke Company.

Further information concerning the new Association will be found in the editorial article previously referred to.

GAS APPLIANCES AND SMOKE ABATEMENT.

Noteworthy Statistics.

We have to make amends to Mr. D. Milne Watson, the General Manager of the Gas Light and Coke Company, and Mr. F. W. Goodenough (the Executive Chairman of the British Commercial Gas Association) for the omission, by our reporter, of some highly interesting and imposing statistics, relating to the growth of the use of gas as a fuel, from our report of their evidence before the Departmental Committee on Smoke Abatement, which statistics deserve all the prominence that can be given to them as showing the effective part that gas has taken, and is taking, in the displacement of smoke-producing fuels.

STATISTICS AS TO CONSUMERS.

The figures produced by Mr. Goodenough, being the result of an investigation by the British Commercial Gas Association, are of most general interest, and are particularly striking. For the purpose of the Departmental Committee's inquiry, the Association sought returns from all gas undertakings annually supplying 50 million cubic feet of gas and upwards; and statistics were received from 206 concerns. In the ten years ending December last, the aggregate number of the gas consumers of these concerns advanced from 3,368,000 to 5,056,000—this being largely due to the increase in prepayment consumers from 1,071,000 to 2,543,000. In the districts of the same undertakings, the prepayment gas consumers now slightly exceed in number (2,543,000, as against 2,513,000) those using gas through ordinary meters.

GAS-COOKERS.

Of the undertakings that made returns, 189 supply gas-cookers on hire or free loan. In 1904, there were in use in their districts 971,000 cookers. At the end of 1913, this number increased to 2,378,000, or nearly 150 per cent. During the same period, upwards of 200,000 cookers were also sold in the same districts by the gas undertakings.

GAS-FIRES AND OTHER HEATERS.

Regarding gas-fires and heating stoves, 112 of the undertakings now supply gas-heaters on hire; and the number of these so supplied increased from 74,000 in 1904 to 342,000 in 1913. In the decade, 238,000 gas-heaters were also sold by the gas undertakings, in addition to the considerable number bought through ironmongers, stores, &c.

WATER-HEATERS.

Speaking of water-heaters, Mr. Goodenough informed the Departmental Committee that this is a comparatively new development on present lines. Of the reporting undertakings, 57 are renting-out water-heaters, and had supplied 24,000 at the end of 1913, as against only 5500 in 1904. Some 110 undertakings sell water-heaters, and disposed of 22,000 in the ten years. It was further pointed out how present indications show that this business of water-heating by gas appliances is destined to become a very large one; and how, in view of this, and the extensive use of the gas-cooker, the smoke-producing coal-range is likely to fall more and more into disuse. The employment of independent water-circulating coke-heated boilers is likewise growing.

INDUSTRIAL USE OF GAS AND POWER.

The use of gas as an industrial fuel was also referred to; but, owing to the ramifications of this use, no reliable statistics could be obtained for presentation to the Departmental Committee. But as to the use of gas for power, 75 gas undertakings which were able to furnish statistics as to the gas-engines in use on their districts report that the horse-power of the engines has increased from 160,000 to 258,000 between 1904 and 1913. This rate of increase has undoubtedly been very general in all industrial centres. Gas-producer plants have also made considerable headway where town gas is dear or local conditions are especially favourable. The same applies to electric-motors. The reduction of the smoke nuisance from these several causes must have been enormous, and is still progressing.

This is a valuable collection of illustrative figures for which the gas industry are indebted to its publicity organization; and they cannot fail to impress the Departmental Committee with the potential and effective agency of gas in suppressing the use of air-polluting solid fuel.

IN THE GAS LIGHT AND COKE COMPANY'S AREA.

By Mr. Milne Watson, the Committee were informed that in the ten years from 1904, the number of stoves of all descriptions supplied by the Gas Light and Coke Company to their ordinary consumers (by way either of sale or hire) increased from 173,000 to 425,000. In addition to these stoves, the cookers used by prepayment consumers have advanced from 130,000 to 379,000. So that during the decade there was an increase in gas appliances of 80 per cent. In the same period, the Company's sale of gas advanced by about 5000 million cubic feet.

COST OF COOKING A DINNER.

In commenting last week upon the evidence before the Departmental Committee, we pointed out that the 3d. quoted by Mr. Milne Watson for cooking a dinner was rather a high one. It appears that this figure was cited, while dealing with the subject of the use of coke-boilers in large houses, and was intended to refer to a dinner of several courses of a household containing many members.

A RECORD OF PROGRESS.

Enterprise at Enfield.

THE present and the future make such extensive demands upon one's time and attention that very often scant opportunity is offered for reflecting upon the past. This is a pity; for the study of history is both fascinating and helpful. Invaluable aid in finding out what to do—and sometimes what not to do—may be secured from a study of what others have done before; and records of successes and of difficulties overcome are frequently found efficacious in arousing a spirit of emulation in those who peruse them. The history of the gas industry is peculiarly rich in records of such successes. In fact, there are so many instances that in ordinary circumstances the student might find himself embarrassed by the wealth of material available to select from. Sometimes, however, extraordinary circumstances arise—such as an amalgamation by which a company ceases to have separate existence—which may be accepted as singling an undertaking out for historical reference. This is the case with the Enfield Gas Company, which, as from the end of last year, became part of the Tottenham District Light, Heat, and Power Company; and it was with the desire of setting out some facts and figures which may prove interesting and useful to others that the writer some days ago sought an interview with Mr. C. W. Offord, whose position has changed from that of General Manager and Secretary of the Enfield Gas Company to that of Deputy-Manager of the Tottenham Company—of which, of course, Mr. A. E. Broadberry is Engineer and General Manager.

Mr. Offord had much to say on a subject congenial to him; for not only did the Enfield Gas Company enjoy a highly successful career, but the place itself possesses many historical associations. Traces are to be found of habitation in pre-historic times—a trifle of 100,000 years or so ago—as well as evidences of Roman, Saxon, Dane, and Norman. A number of illustrious personages, including Alfred the Great, Queen Elizabeth, and James I. have had some intimate knowledge of the now Royal Manor; for since 1399, when Edward IV. was king, the Manor of Enfield, which he held at that time as Duke of Lancaster has formed part of that Duchy. In 1850 when the Enfield Gas Company was formed by deed of settlement, the town was sharply detached from its nearest neighbours. Charles Lamb, who was living in the parish just before that time, in writing to Wordsworth, described it as "a little teasing image of a town, with shops two yards square." As a matter of fact, at the date named it had only for three or four years had immediate connection by a railway track with the Eastern Counties and Cambridge line, close to the works of the Tottenham Gas Company at Angel Road. Down to this time communication with London had been kept up by coach. At present, the population of Enfield parish is, roughly speaking, divided into three groups—Enfield, Enfield Lock, and Ponder's End. As time goes on, of course, there is an increasing tendency observable for these groups to merge into a whole; and Edmonton, which is in the district of the Tottenham Company, is now overflowing into Enfield. But there still remains ample room for expansion; so that the Tottenham Company are to be congratulated upon having taken over a district in which they can fairly look for a large growth of consumption.

Gas was first supplied to Enfield at the end of January, 1851; the rental from the date of first supply until the end of 1852 amounting to £768. This, at 6s. 8d. per 1000 cubic feet, which was the selling price, represented 2,304,000. Thus, for the broken part of the first year of operation (from February to December), barely 1,000,000 cubic feet would be represented on the income side of the revenue account. The total population, as given in the census of 1851, was only 9453. The concern was registered as a Limited Company under the Joint-Stock Companies Act in October, 1856; and incorporation by Special Act followed in 1867—the limits of supply covering an area of some 20 square miles, comprising nearly all Enfield and a small part of Edmonton.

In diagram form will be seen some statistics, compiled by Mr. Offord, showing the progress of the Company during his connection with it—which dates from the year 1883. The information afforded by the diagram deals with the growth in the number of consumers, in the quantity of gas sold, and in the capital expended; and it will be noticed that, whereas in the first year dealt with (1883) the number of consumers was 800, the quantity of gas sold in round figures 29 million cubic feet, and the capital expended £56,000, during 1913 (the year before the amalgamation with the Tottenham Company took place) the number of consumers was 11,201, the gas sold nearly 269 million cubic feet, and the capital expended £197,656. Going more closely into these figures, it is found that at the earlier date 20·5 per cent. of the inhabited houses were supplied with gas, the average yearly quantity of gas used per consumer was 30,000 cubic feet, and the capital expended per million cubic feet of gas sold was £2012. The corresponding figures for 1913 were 97·05 of inhabited houses supplied with gas,

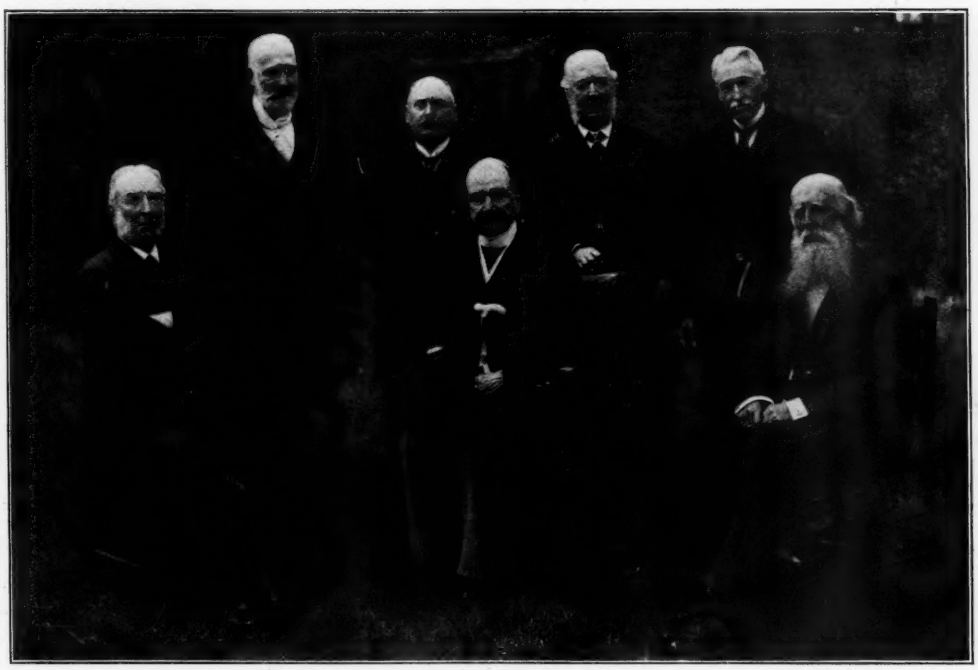


Photo. Elliott and Fry.

A PHOTOGRAPH TAKEN IN AUGUST, 1913, OF THE DIRECTORS AND GENERAL MANAGER OF THE ENFIELD GAS COMPANY.

From left to right—Sitting: Mr. A. L. Ford, J.P. [1882]; Colonel Sir A. P. F. C. Somerset, K.C.B., Chairman [1861]; Dr. James Collyer [1873]. Standing: Mr. H. C. Weld [1882]; Mr. C. W. Offord [1882]; Mr. J. W. Ford, D.L., J.P. [1873]; Mr. F. G. Fitch, J.P. [1884]. The dates given in brackets show the year of each Director's first election, and of the General Manager's first appointment.

an average yearly consumption of 23,000 cubic feet per consumer, and a capital expenditure per million cubic feet of gas sold of £736. The lower quantity of gas used per consumer, of course, followed, as a natural consequence, on the introduction of the prepayment meter in 1894.

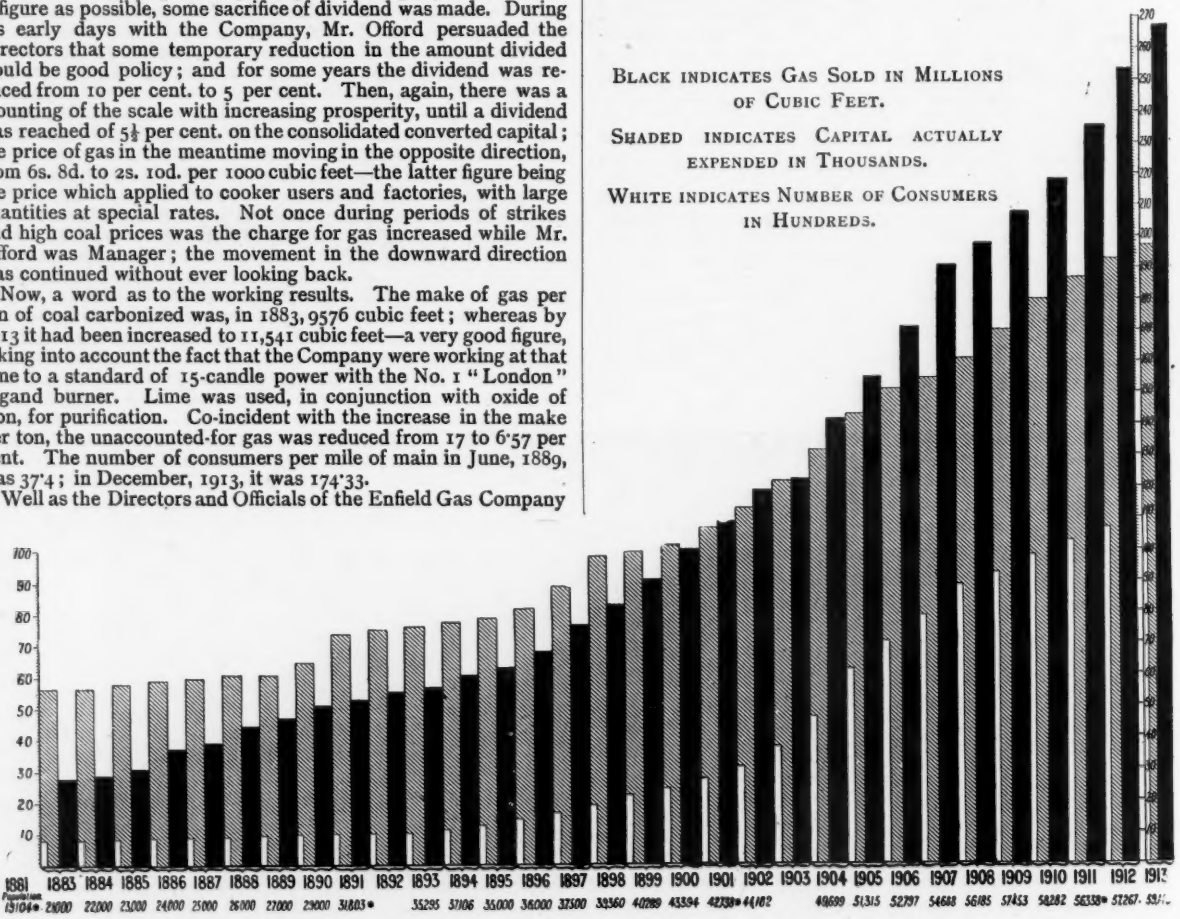
With reference to gas-cookers, the letting of these out on hire was taken in hand in 1886. One make only was dealt with, in which way any difficulties and expenses that might be attendant upon the listing of a large number of different makes were avoided. This business of cooker-hiring, too, was fostered by what, at that somewhat far-away time, could only be regarded as very generous terms indeed. The fixing was carried out free of charge under ordinary circumstances; and the rentals were nominal. Then, instead of making a separate charge for all gas used with cookers (or for industrial purposes), the Company put into operation a special preferential rate wherever a gas cooker was used or an industrial supply was taken; this low rate applying to all gas used, no matter for what purpose. This special price was 3d. per 1000 cubic feet less than the amount chargeable to ordinary consumers. In the year 1913, the average quantity of gas used by the ordinary consumers without cookers was 31,000 cubic feet a year; whereas the preferentially treated class, which included the people having cookers (but not public institutions, halls, places of worship, and similar premises), consumed over 52,000 cubic feet on an average. The amount of gas taken per slot-consumer per year worked out at 14,400 cubic feet. Of the total of 11,201 consumers in 1913, there were 2325 ordinary, preferential, and institutions, and 8876 prepayment. Preferential consumers accounted for 1170 cookers, and the prepayment meter users for 6784. These figures were combined, as already remarked, with another which will be regarded with envy by many people—namely, a proportion of inhabited houses unsupplied of less than 3 per cent.

In order that the price of gas might be brought down to as low a figure as possible, some sacrifice of dividend was made. During his early days with the Company, Mr. Offord persuaded the Directors that some temporary reduction in the amount divided would be good policy; and for some years the dividend was reduced from 10 per cent. to 5 per cent. Then, again, there was a mounting of the scale with increasing prosperity, until a dividend was reached of 5½ per cent. on the consolidated converted capital; the price of gas in the meantime moving in the opposite direction, from 6s. 8d. to 2s. 10d. per 1000 cubic feet—the latter figure being the price which applied to cooker users and factories, with large quantities at special rates. Not once during periods of strikes and high coal prices was the charge for gas increased while Mr. Offord was Manager; the movement in the downward direction was continued without ever looking back.

Now, a word as to the working results. The make of gas per ton of coal carbonized was, in 1883, 9576 cubic feet; whereas by 1913 it had been increased to 11,541 cubic feet—a very good figure, taking into account the fact that the Company were working at that time to a standard of 15-candle power with the No. 1 "London" argand burner. Lime was used, in conjunction with oxide of iron, for purification. Co-incident with the increase in the make per ton, the unaccounted-for gas was reduced from 17 to 6·57 per cent. The number of consumers per mile of main in June, 1889, was 37·4; in December, 1913, it was 174·33.

Well as the Directors and Officials of the Enfield Gas Company served the consumers and the shareholders, advantages all round are anticipated as a result of the amalgamation with the Tottenham Company. From the consumers' point of view, there is the quicker rate of reduction that they might expect to secure thereby; while shareholders obtained an advantage in the exchange of their holdings. With reference to the employees, co-partnership was started by the Enfield Company in 1909; and the benefit which accrues to them from the amalgamation is that they have been brought into an undertaking which is now paying a bonus of 9 per cent., as compared with the 4½ per cent. of the Enfield Company. Thus consumer, shareholder, and workman all directly benefit; while as for the Tottenham Company, they have secured an enlarged field for their activities, of which they may be safely relied upon to take the fullest advantage. From his own experience, Mr. Offord felt unable to speak with authority on the subject of co-partnership; but he has, at any rate, found with certainty that it serves two purposes—to discover the good man, and also to reveal the man who is not worth considering. It may be noted that under the Enfield Company the shopkeepers (the most important of whom are clustered closely together) have had the advantage of a high-pressure supply, from a main about two-thirds of a mile in length; the lamps being supplied at an inclusive charge, including hire and maintenance.

The accompanying photograph imparts a close personal touch to these notes. Though taken in 1913 it shows, with one single exception, the Board as Mr. Offord found it when he joined the Company some thirty years since. There are included in the group the Chairman, Colonel Sir A. P. Somerset, K.C.B., and Mr. J. W. Ford (the latter of whom has joined the Tottenham Board). The change now made has brought Mr. Offord back to his "first love," for he originally went from Tottenham to Enfield in 1883, and now has returned—"not," as he himself aptly put it, "as a prodigal son, but bringing a profit in his hands."



* The figures to which asterisks are attached are from the census returns. The other figures are only intermediate estimates.

Among the correspondence in the current "Bulletin" of the British Commercial Gas Association is a letter to Mr. W. M. Mason, from his colleague of the American Association (Mr. Louis Stotz). In the course of it he gives some particulars as to the course of instruction in the utilization of gas appliances which the Association are conducting this year, and which he says has been very successful. They have 3850 students enrolled, and have received approximately 2700 answers to lesson No. 1, 2000 to No. 2, and 1000 to No. 3. Mr. Stotz says the calibre of the answers coming in is of a very high order, and shows that the men are very much interested in the work and are receiving direct benefit from the study.

We learn from Mr. George G. Ramsdell, the Secretary and Treasurer of the American Gas Institute, that for the accommodation of the members of the gas organizations and their families and friends who contemplate attending the International Gas Congress to be held in San Francisco in September, 1915, the Transportation Committee have arranged for two special trains from New York and from Chicago. They will include baggage car, buffet-club car, standard drawing-room and compartment sleepers, dining car, and observation lounge car, and will be brilliantly lighted. Special attention has been given to the routing of the trains, so that those who travel by them may enjoy the maximum amount of scenery and comfort in the minimum time.

THE "LONDON" COKE-FIRED HOT-WATER SUPPLY BOILER.

THE London Coke Committee (of which Mr. D. Milne Watson is Chairman, and Mr. E. E. Rudge, of the Gas Light and Coke Company, is Secretary) are going about their work in an energetic and efficient way. They are not content with merely providing literature, expert advice, and so forth for the development of sales, but they have their own views, which they are putting into material form, as to what constitutes the best and proper means for the utilization of coke. There is an enormous amount of work to be done in large houses in the provision of an economical means of water heating—not supplementary to, but absolutely in place of, the existing smoke-producing methods. For large houses, where a considerable quantity of hot water is constantly being needed, there is no doubt that the coke-boiler spells economy, although for ordinary houses the labour-saving gas-circulator is, unquestionably, the better system of supplying needs. But in large houses the matter is on a different basis. The London Coke Committee have so designed a new coke-heated boiler that the labour necessitated in connection with the ordinary sizes is of a very modest order. It only demands to be fed with coke twice a day; and a simple rocking-grate has been incorporated so that dust and ashes can be readily removed. It has a further advantage—which, with a gas-cooking range fixed reduces the ordinary coal range to a superfluity and an encumbrance—in that a front drop door has been provided, in order that, fixed in the kitchen, the boiler gives a splendid radiant fire for all warming purposes during the winter, as well as a good heater for irons. At the top of the boiler, there is a shoot, into which the refuse of the house can be placed for consumption; and so the boiler likewise forms a good sanitary adjunct to the large household. The Committee have made arrangements for the supply of these boilers, at a reasonable price, to the gas undertakings forming the finance-contributing membership; and, of course, as the Committee are desirous of benefiting the industry generally in connection with the development of local coke markets, any other concerns can secure the boiler—also on reasonable terms.

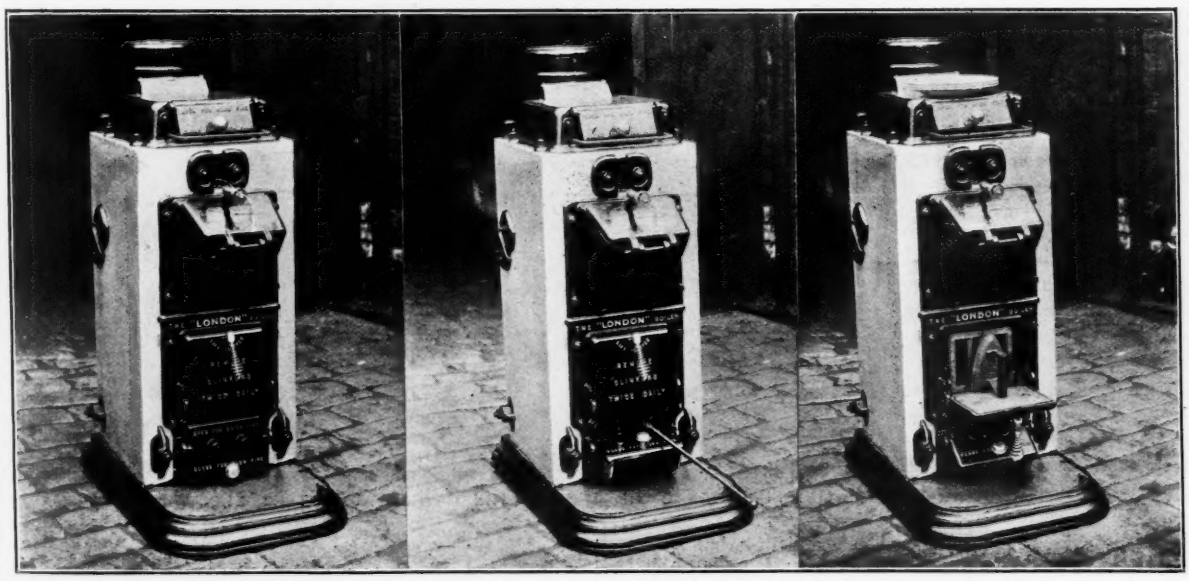
The boiler is substantially built, and has indubitably a good life before it. The three illustrations will convey this impression to the mind of the reader. The first shows the boiler closed; the second, with the rod (which also serves as a poker) in position for operating the rocking-bars for shaking out the dust and ashes; and the third with the drop door down and a flat iron undergoing heating.

The characteristics of the boiler are worth examination in more detail. As seen by the illustrations, it is rectangular in form, and compact. Standing on a base-plate in the tiled chimney recess, it has a serviceable look about it; and its actual operation does not belie the appearance. The fire-box is so arranged that the maximum economy in fuel consumption is ensured; while ample provision has also been made for cleaning the interior. Good waterways are an essential in such boilers; and those in this boiler are exceptionally wide, rendering it particularly suitable for hard water. Spacious handholes afford ample provision for clearing the interior; and it is noted as another feature that all the joints are made on the inside of the plates. Speaking of the plates, these are of mild steel, and are of full thickness throughout—none of them being either bulged or thinned in any way during the manufacture of the boiler. Mild steel has been selected for the boiler owing to it being stronger than cast iron, and being a much better conductor of heat.

The plates being of uniform thickness, with smooth surfaces, the latter are easier to keep clean than are those of a cast-iron boiler. The bottom plates of the water-pocket and of the top waterway are corrugated, so that unequal expansion shall not affect them. Where necessary, the boiler is stayed; and it is tested by hydraulic pressure to 75 lbs. per square inch, or 150 feet column of water, which is a complete assurance on the score of safety.

Regarding minor structural points, the doors, frames, &c., are made of good quality cast iron, and are of substantial thickness. The castings are all attached to the boiler by studs and nuts; the studs being firmly caulked into the boiler, so that any casting may be promptly removed for repairs or renewal without emptying the boiler. The smoke outlet is simply a socket made to the British standard. By removing four studs, the socket may be turned to a horizontal position if required.

Allusion has already been made to the rocking form of grate, which is removable through the door opening. The rocking grate, shaking the dust from the fire, reduces the amount of clinker formed. As illustrated in the second photograph, the shaking of the grate is performed by a rod resting on the pin provided on the ash-door; the point of the rod engaging the rocking-bar. The manner in which every detail has been studied has example in the fact that the grate has deep ribs underneath, which keep it cool, and prolong its life. The fire is regulated by a slide-damper, as well as by the ingress of air under the grate and into the flue. The air-inlets are simple doors, which remain in any position in which they may be placed. The admission of air into the flue prevents any smell of sulphur when working with a slow fire.



Showing Boiler Closed. Showing the Operation of the Rocking Grate. Showing an Open Fire with Irons Warming.

THE "LONDON" COKE BOILER.

In addition to the drop-door revealing a cheerful radiating fire, and providing means for heating flat-irons, the top of the boiler supplies a useful hot-plate.

Designed to burn broken coke (No. 2 of the London Coke Committee's standard grades of gas coke), as well as domestic refuse, the rating of the boilers is expressed in gallons of water heated per hour to an average temperature of 130° Fahr. from an inlet temperature of 50° Fahr. The boilers are made in a range of five sizes—*i.e.*, 26, 40, 60, 80, and 100 gallons per hour. The average consumption of coke for (say) a 60-gallon boiler is estimated at not more than 6½ lbs. per hour when working at full capacity.

It will be seen from this description that the "London" coke-fed boiler is particularly well adapted for fixing in any kitchen; and, in conjunction with a gas-stove, it enables the old-fashioned kitchen coal range to be discarded, and gives a hotter and more regular supply of hot water than the range boiler could possibly do. It also provides heat for the kitchen on winter days, and so entirely overcomes the objection to the discarding of the ordinary coal range.

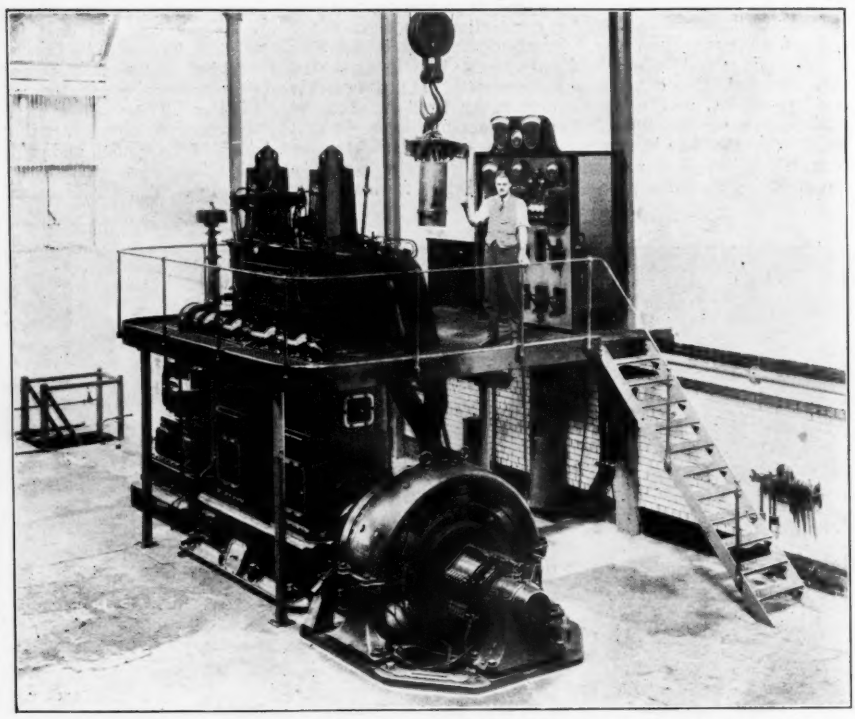
There is no question at all about it, we are on the verge of the transformation of our large house kitchens from smoke-producing fuel operation to the smokeless vogue, by the use of gas-cooking ranges and coke-boilers, and smaller class houses by the use of gas-cookers and gas-heated circulators. It is found that servants appreciate gas and coke heating, seeing that both methods

lighten labour, show greater efficiency in results, and contribute to cleanliness.

The London Coke Committee have also lately issued for sale a reproduction of a coloured photograph illustrating the conditions of an ideal kitchen, which was specially constructed, at some considerable expense, at Horseferry Road for the purposes of the photograph. A copy of the picture has only to be seen to be admired. The refinement and restfulness about it gives it a distinctiveness beyond the usual three-colour reproduction of even clever artists' work. Of particular interest is the stereoscopic effect, whereby the different objects in the kitchen project upon one's notice in the most natural manner. The main object of the photograph is to depict how a gas-cooker can be used in conjunction with a coke water-heater for all purposes of cooking, destruction of house refuse, and provision of hot water throughout a house—and this with a maximum of efficiency, convenience, and economy.

THE FULLAGAR INTERNAL COMBUSTION ENGINE

At the joint meeting of the Institutions of Naval Engineers and Shipbuilders, held at Newcastle-upon-Tyne, the members were able to witness a demonstration with a new internal combustion engine. The engine, a 500 H.P. one, built by Messrs. W. H. Allen, Son, and Co., of Bedford, has been erected in the engine-room of the Electric Supply Company, at Gateshead. It is of the stationary type, weighing (including the fly-wheel) under 22 tons, and is used to drive a generator coupled to the Electric Company's mains. It is named the "Fullagar" engine; and the principal features of it will be gathered from the following extracts which have been taken from a paper read by Mr. H. F. Fullagar, during the meeting in question.



THE FULLAGAR GAS-ENGINE AT THE GATESHEAD-ON-TYNE ELECTRICAL WORKS.

Three fundamental factors are chiefly responsible for the difficulties in the construction of internal combustion engines of existing types—difficulties which increase with the size of unit, and ultimately limit the power which can commercially be built. These factors are: (*a*) That the heat per unit of surface radiated by the flame to the cylinder walls increases with the size of the cylinder, while the thickness of metal through which this heat has to reach the cooling water also increases; (*b*) that the weight per horse power increases with the size of the cylinder; (*c*) that useless forces are called into play—useless in that they are either stationary and do no work or even produce negative work. These result from (1) the fluid pressure on the cylinder covers, which has to be transmitted through the framing of the engine; (2) the negative work of the compression stroke, which in single-acting engines produces a reversal of twist in the crankshaft; and (3) the inertia forces resulting from want of balance, and imperfect cushioning. The Fullagar internal combustion engine eliminates these factors, and has besides the advantages of mechanical simplicity and accessibility.

Construction of the Engine.

The construction, which is shown diagrammatically in figs. 1 and 2, consists in using as a unit two open-ended cylinders side by side, each with two pistons, and rigidly connecting the pistons A to D, and C to B, by means of pairs of oblique rods, external to the cylinders. The action of the engine is as follows: An explosion taking place between A and B drives B down and A up, drawing up D by the oblique rods, and giving, through the two connecting-rods, two equal and opposite impulses to the two cranks. The side thrust produced by the oblique pull is, of course, taken by the crossheads of A and D, which are provided with suitable guides for the purpose. The obliquity of the rods is small, less than the maximum obliquity of the connecting-rods, so that the friction is actually less than would be the case if each piston had its own crank and connecting-rod; and the mechanical efficiency of the engine is high. At the ends of their strokes the pistons uncover inlet and exhaust ports in the cylinder walls, as in the "Oechelhäuser" arrangement. The engine works on the "two-stroke" cycle, and each crank receives, therefore, two impulses per revolution. Air is supplied to the cylinders by low-pressure air-pumps, which can be driven from the engine by side levers in the ordinary way.

It will at once be clear that with this construction useless forces are avoided or greatly reduced. There are no cylinder covers or, in fact, any high-pressure joints in the engine. There are no vertical stresses on the framing of the engine at all. The pressure of the explosion is entirely taken between steel parts—namely, the cross-head, oblique rods, connecting-rods, and crankshaft; and only the secondary reactions of the slippers, from one-fifth to one-twentieth of the explosion forces, reach in a horizontal direction the framing of the engine. The fluid pressure in each cylinder acts at every moment equally on the two cranks. The main bearings are thus relieved of practically all load, except for the weight of the parts which, acting vertically, is just sufficient to keep the bearings in constant thrust. The action of the explosion in driving apart the pistons A and B draws together, by means of the oblique rods, the pistons C and D, compressing the charge between them, so that the negative work of compression is performed, not through the crank and connecting-rods, but directly through the oblique rods, and only the net useful work is transmitted to the crankshaft. The reciprocating parts are cushioned at each end of every stroke.

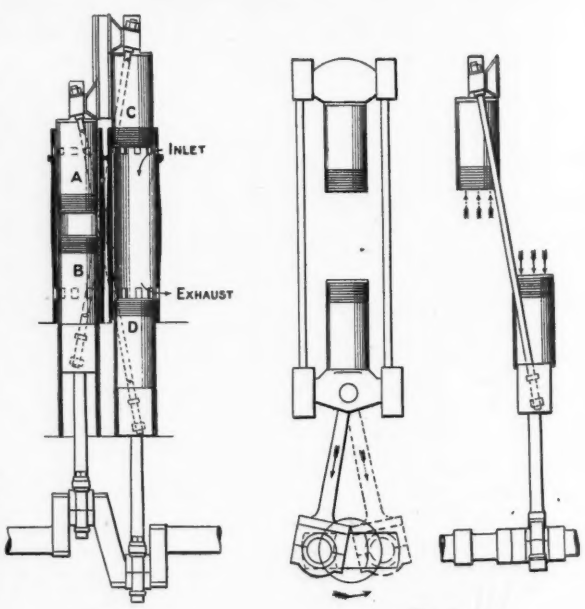


Fig. 1. Fig. 2.

Sections Showing the Pistons of the Fullagar Engine.

This follows from the fact that each stroke includes a compression and explosion. On the up-stroke, the pistons A and D, for instance, are cushioned by the pressure on D, and on the down-stroke by the pressure on A. The combined effect of inertia and cushioning is to keep the oblique rods, except in the case of very small engines, in constant tension.

The effect of inertia is also to make the crank effort much more uniform. When an explosion occurs between (say) A and B, the force reaching the gudgeon-pin of B is less than the explosive pressure on B, by the inertia of the connected pistons B and C with their crossheads and oblique rods, whose acceleration is at that moment at a maximum. The cost of an engine is largely determined by the maximum pressure to which its cranks are subjected, but it is the mean effective pressure which determines its useful output, and the nearer the maximum is to the mean the lighter and cheaper the engine. In single-acting engines, whether of the simple, tandem, or Oechelhäuser type, the explosion and compression strokes twist the crankshaft alternately in opposite directions, producing a severe condition of stress; but with the new construction, each connecting-rod is double acting, and the effort of each crank is uniformly in one direction. A four-crank engine, therefore, receives four pairs of balanced impulses per revolution, eight in all; so that the turning effort of this engine is unusually uniform.

The balance which results is practically perfect. The centre of gravity of a pair of pistons, A and D, for instance, moves up and down on a line between the cylinders, while the centre of gravity of the other pair moves down and up on the same line. This is probably the only engine in which the centres of gravity of the balancing masses have the same identical locus. Such, then, are the working forces in this mechanism. If they be divided into the rough classes, which for the purpose of this brief description I have called "useful" and "useless" forces, the only ones falling into the latter class are the minor reactions from the slippers at the ends of the oblique rods, constant in direction and less, both in number and amount, than the "useless" reactions of any other reciprocating engine in common use, whether gas or steam.

As regards weight, the new construction, by combining eight two-stroke pistons with four cranks, produces a given power upon one-half to one-third the weight required with other constructions. The mean effective pressure with the two-stroke cycle need not be less than three-quarters of that with the four-stroke cycle. An engine of the new type is therefore equivalent to a four-stroke engine with not less than twelve pistons of the same size. Since larger cylinders are heavier for their power than smaller ones, a four-stroke engine of the same power with fewer cylinders of larger dimensions will be still heavier. Clearly, therefore, the saving in weight of the new construction is very considerable.

From a heat point of view, the double type of cylinder has incomparable advantages over all others, and with the new construction such cylinders require but one crank each. In form, the cylinder is a plain tube, supported at either end, but free to expand axially, and surrounded with its fellows by a common tank, forming the water-jacket. In such a cylinder temperature stresses cannot occur. If a tube free to expand be heated symmetrically, so that its temperature around each zone is uniform, variation of temperature along the axis of the tube produces no stress whatever. Moreover, in the absence of corners or pockets, the actual mean temperature of the inner surface of the cylinder is very low.

The Demonstration Engine.

To prove the system on a practical scale, an engine to give 500 B.H.P. was, as already mentioned, built by Messrs. W. H. Allen, Son, and Co., of Bedford, to the designs of the Fullagar Engine, Limited, and installed in the engine-room at Gateshead. The engine, which is of the stationary type and of substantial proportions, weighs, including flywheel, under 21½ tons. It gives continuously some 550 B.H.P.; and its weight is, therefore, less than one-half that of gas-engines of equal power. This result is obtained with four cylinders only 12 inches in diameter, with a moderate piston speed of 750 feet per minute, with the low mean effective pressure of 70 lbs. per square inch, a maximum stress in the steel parts of only 3·8 tons per square inch, and a stress in the cast-iron portions of the engine nowhere exceeding three-quarters of a ton. The engine, in fact, produces its power upon one-half the usual weight of material, and under conditions of running which, so far from being severe, are in the main easier than exist in reciprocating steam-engines.

This particular engine is supplied with air and gas by auxiliaries of a somewhat makeshift and inefficient character—the air by a fan and the gas by a pump. In spite of this, Professor Hopkinson finds the overall efficiency during 30 hours, from heat of gas supplied to brake horse power, to be just under 30 per cent., while the indicated efficiency is no less than 37·6 per cent.; the difference being largely accounted for by the inefficient auxiliaries. The mechanical efficiency of the engine itself is stated to be about 90 per cent.

The normal speed of the engine is 250 R.P.M.; and even if this is increased to 300 R.P.M., the engine is said to be still remarkably free from vibration. An upper piston can be withdrawn in about ten minutes after stopping the engine, and the lower piston lifted out through the cylinder in five minutes more. The whole of the eight pistons can be withdrawn in an hour, with the use of a hand-crane only.

Recent researches have made it possible to calculate the temperature in the walls of a cylinder, when this is of simple form. It has been ascertained that the temperature of the interior surface of a cylinder of the demonstration engine never exceeds 160° C., while that of a cylinder 3 feet in diameter would not exceed 360° C. An engine with four cylinders 2 feet in diameter will, it is claimed, with either coke-oven or producer gas as fuel, easily give 2500 B.H.P. With 3 feet cylinders such an engine would give 5000 B.H.P.; while a six-cylinder engine with 3 feet cylinders will have an output of 7500 B.H.P.

Reports upon Tests.

In the course of his report upon tests of the demonstration engine, Professor Hopkinson summarizes the results of his thirty-hours trial as follows:—

		Corresponding Mean Pressure at 249 R.P.M. Pounds per sq. in.
Average B.H.P. during thirty hours . .	510	50·5
Power used to drive the fan	50	4·9
Power indicated in gas-pump	14	1·4
Friction of engine and gas-pump . . .	67	6·6
Total (Indicated H.P.)	641	63·4

The average consumption of gas per brake horse power hour was 18·1 cubic feet, and the average lower calorific value of the gas was 470 B.Th.U. per cubic foot; the volume, both for the engine and the calorimeter, being measured at the temperature and pressure of the room. This corresponds to a thermal efficiency reckoned on the brake power of just under 30 per cent. This efficiency, he says, is quite satisfactory, being nearly, if not quite, equal to that obtainable under similar conditions from any four-cycle gas-engine now on the market, and probably better than that of any two-cycle engine. On account of the rather large amount of power absorbed in the air-pump in these experiments, the ratio of brake horse power to total indicated horse power is rather low, being not more than 80 per cent., and the efficiency reckoned on the indicated power is correspondingly high (37·6 per cent.). This is due to the high piston speed, and the cylindrical form of combustion chamber, which, together with the comparatively low mean pressure, led him to expect a higher indicated efficiency than has usually been obtained in gas-engines hitherto. With the better pumping arrangements proposed in the new design, which would give higher mechanical efficiency, the engine when using coal gas, or any gas with a high calorific value as in the trials now reported on, will, he adds, be exceptionally economical in fuel.

The engine has also been reported upon by Mr. Percy R. Allen, who says that, from the drawings and figures supplied to him, it appears that the stresses and bearing pressures in the Fullagar engine are very moderate; and taking these parts into consideration with the very good balance, the entire absence of glands and cylinder valves, and the accessibility the system affords, he sees no reason why the cost of running and maintenance should not be as low as that of any existing type of gas-engine. The tests of the engine at Gateshead have already indicated that the consumption of fuel of these engines will be entirely satisfactory.

Natural Gas for Making Petrol.

In a report submitted to the United States Bureau of Mines, Mr. George A. Burrell remarks that in almost every oil-producing State in the Union petrol is being extracted from the natural gas which accompanies the oil. In the year 1911 about 7,500,000 gallons were produced in this way. The treatment of the gas consists in compressing it to 25 to 50 lbs. per square inch, and passing it through cooling-coils, made of 2-inch pipe, on which water at ordinary temperature is sprayed. At some plants the coils are immersed in tanks. Some liquid constituents are recovered at this stage of the process; but the quantity is comparatively small. The residual gas from the first compression is subjected to pressures as high as 350 lbs. per square inch, and then cooled in the same manner as before. The greatest amount of liquid that is obtained after the second compression and cooling may range from 1½ to 4 gallons per 1000 cubic feet of gas treated. The liquid is received in tanks under heavy pressure. For marketing it is withdrawn and usually mixed with low-grade refinery naphthas. In the operations described, several changes occur in the gas, such as condensation of vapour, liquefaction of gas, and solution of some permanent gases in the liquid produced. That chemical changes occur—that is, a "cracking" of paraffin hydrocarbons at the temperatures and pressures used—is unlikely. The liquid collected in the receiving-tanks may be very volatile—"wild," as it is called in the trade—and range in specific gravity from ·676 to ·582 (77° to 110° Baumé). Consequently there is a considerable loss when it is exposed to the air. This loss may range from 10 to 50 per cent. or more of the original liquid. Blending of the material with the refinery naphthas should be performed as rapidly as possible, and as soon after manufacture as can be arranged.

The Consumption of the Meker "00" Burner.—In the notice of the Lyons Exhibition which appeared in the "Journal" last week, the consumption of the above-named burner, which was referred to, under the heading of "Sundry Exhibits," on p. 95, should have been given as 0·42 cubic foot for an illuminating power of about 10 candles.

ILLUMINATION IN THE HOME.

Towards the close of a lecture delivered by Mr. R. F. PIERCE. before the Indiana Gas Association, on "The Principles of Illumination Applied to the Home," the author made the following remarks:

When we attempt to light a room by artificial means, we encounter degrees of brightness far exceeding any object in Nature with the exception of the sun. Each square inch of the incandescent gas-mantle gives from 60 to 90 candle power; and the filament of the tungsten lamp gives 1200 candles or more. No one need be told of the injurious effects of such degrees of brightness; it is a matter of common experience. Yet contrast has much to do with our sense of discomfort. Place a tungsten lamp of any size between your eyes and a north window. The brightness, though uncomfortable after a time, is by no means blinding. Draw a heavy shade over the window, and the discomfort, due to increased contrast, is immediate and intense. Close your eyes, and the long time which the after-image persists gives evidence of the actual injury sustained by the retina of the eye. The same experiment upon an incandescent gas-mantle will produce similar results; but the after-image will persist a comparatively short time—showing that the injury has been less severe.

From these few facts of every-day experience and simple experiment we are able to draw the general conclusion that—given sufficient light to see without straining the eyes, and steady unwavering illumination—the eye can perform its functions easily and comfortably over a tremendous range of conditions, unless excessive contrasts of brightness fall within the range of vision. This last is the most difficult condition to meet. While there is no test by which a lighting system may be pronounced absolutely innocuous or the reverse, an excellent comparative test may be made without the aid of any other apparatus than a watch. By looking at any source of light for (say) two or three seconds, then shutting the eyes and determining the time required for the after-image to disappear, the persistence of this after-image is a measure of the strain upon the retina of the eye.

We have seen that the whole lighting system is concerned mainly with the distribution of brightness. The brightness of a surface depends upon two things: (1) The extent to which the light received by the surface is concentrated; and (2) the character of the surface, the amount of light absorbed by it, and the manner in which light is reflected from it. A silvered mirror and a piece of white blotting-paper absorb light in about equal proportions; but the difference in brightness is very great. Viewed at the angle at which the reflection of the light source appears, the brightness of a mirror is almost that of the source itself; while viewed from other angles the mirror is dark—the brightness is practically *nil*. The blotting-paper, however, appears of the same brightness from whatever angle it is seen.

Thus there are three essentials to be considered in the lighting of a room: (1) The brightness of visible light sources or their shades must not be of a degree to produce objectionable contrasts. (2) The manner in which light is distributed from the lighting unit must be properly controlled, so that surfaces which are desired to be bright shall receive more light than those which are to be darker. (3) Surfaces which are to be bright should be lighter in colour than those which are to be darker. There are an infinite number of ways in which lamps may be arranged and equipped to produce any conceivable effect desired by the user. In most residences, however, the principal rooms are provided with but one outlet in the centre of the ceiling.

[The lecturer concluded by demonstrating, by means of models approximating actual conditions, some of the more important effects obtained by various arrangements of shaded lights and wall coverings in a room so equipped.]

NOTES FROM ABROAD.

Statistics of Dutch Gas-Works.

We have received a copy of the statistics of the working results of gas undertakings in Holland for the year 1912. They have been compiled by de Heer P. Bolsius, of Bois-le-Duc, de Heer M. van der Horst, of Amsterdam, and de Heer G. A. Brender à Brandis, in the same careful and complete manner as were the issues for the three previous years. Nine works have been added to the statistics, bringing the total up to 159. Some idea of the completeness of the work may be gathered from the fact that the information is divided under no less than 141 columns, and some of the large works, such as Amsterdam, have a figure, name, or date under almost every heading. For purposes of comparison they must be invaluable to Dutch gas managers, as they can see how they stand with regard to other undertakings in almost every conceivable point.

Gas Chemists' Meeting.

The "Journal für Gasbeleuchtung" for Saturday reports that some fifty gas-works chemists from Germany and neighbouring lands attended the meeting held at the Instructional and Experimental Gas-Works at Karlsruhe on July 6 to 8 (as noticed in the "JOURNAL" for June 9). A report of the proceedings at the meeting will be published in due course. A variety of important points and discussions were raised, and the delegates derived much interest from the time they spent at the exhibition.

New German Publications.

From the publishers, Messrs. R. Oldenbourg, of Munich, we have received Vol. X. of the "Handbook of Gas Technique" series, edited by Dr. E. Schilling and Dr. H. Bunte. The title of the volume is "Organization and Management of Gas-Works." It is divided into five sections by five different authors, and contains 29 diagrams and illustrations. From the same publishers we have received a book by Dr. Friedrich Greineder, entitled "The Commercial Side of German Gas-Works," inspired, the author says, by the exhibition, "Das Gas," now being held in Munich. A third book to hand from Messrs. Oldenbourg is the "Annual of Gas Technique" for 1913, compiled by Professor Dr. Strache, of Vienna, on behalf of the Austro-Hungarian Gas and Water Association. Fuller notices of these publications will appear in later numbers of the "JOURNAL."

Gas Cold Storage Plant at Cleveland (Ohio).

According to the American "Gas Institute News," Cleveland (Ohio) now has a model 335-ton all-gas cold storage plant, equipped by the East Ohio Gas Company. Power is furnished through three gas-engines of 150 H.P. and three of 75 H.P.—675 in all—converting gas into electricity for lighting and operating all the machinery for an output of 4 million quarts of ice cream per annum, and sterilizing, filling with pasteurized milk, capping, and delivering 40,000 bottles of milk per day.

Silica in Canada.

The "Financial News" records a valuable find of silica on a ranch in Southern Alberta, on the South Saskatchewan River. The sand has been tested and found to stand a high degree of heat. Further tests which are to be made will probably result in the sand being found useful for several purposes. It can be easily handled and taken to the nearest railway centre on the ice in winter. The deposit is a large one, and shows every indication of being very valuable.

Sulphate of Ammonia from China.

It is reported by H.M. Commercial Attaché at Yokohama that a Mond gas plant is in course of construction at the Fushun coal mines in Manchuria, to supply power for electricity generation. This type of producer-gas plant has been selected chiefly owing to the fact that Fushun coal is specially suitable for sulphate of ammonia recovery. Some 250 tons of coal will be gasified daily, and the production of sulphate from this quantity, it is estimated, will be 12 tons. At present there is little local demand for the commodity, and the intention is to place it on the Japanese market, or, if possible, to ship it to California.

Coke-Dust Briquettes.

The Prussian State Railways have recently put down plant at Wittenberge for the production of briquettes from coke dust. The process adopted is that of Alexander, and the chief feature of it is the use of oil-gas tar as a binding material, which is said to have solved one of the great difficulties of the satisfactory manufacture of briquettes. It is claimed that this is a more economical way of using up the coke dust even than burning it in furnaces of special construction, the briquettes are easy to handle, readily inflammable, hold together well until completely consumed, and produce little smoke. So satisfactory has this trial plant proved, that seven others are on order or being constructed in Prussia.

Gas Consumption in Japan.

The June number of the "Journal of the Imperial Gas Association of Japan" gives some interesting statistics. A rough calculation shows the annual gas consumption for recent years as somewhat over 4500 million cubic feet, of which Tokyo and its suburbs accounted for more than 3000 million cubic feet, with a consumption of 1340 cubic feet per head of population. Osaka comes next with 647 million cubic feet, Nagoya 258 millions, Kobe 236 millions, Kyoto 162 millions, and Gifu 118 millions. No other undertaking reaches even 40 million cubic feet, while the highest consumption per head outside Tokyo is 595 cubic feet by Nagoya. Figures per consumer show that Shimonoseki leads with 13,540 cubic feet for a 25-million consumption; Tokyo coming about sixth on the list with 10,319 cubic feet. Some of the small undertakings must find existence rather difficult, especially when it is realized that only seven out of eighty companies recover bye-products, many throwing away ammoniacal liquor. Kyoto and Gifu, with makes of 162 and 118 million cubic feet respectively, are not mentioned among the seven.

Gas Used in Japanese Funeral Rites.

Gas was used extensively in the funeral rites at the burial of late Dowager Empress of Japan at Yoyogi. It was introduced into the sacred enclosure in 2-inch to 8-inch mains. At the entrance gate were twelve gas watch-fires of 15,000 c.p. each, four of 10,000 c.p., and six of 5000 c.p. There were two others of 10,000 c.p. each, fourteen of 5000 c.p., sixty of 3000 c.p., and two hundred of 300 c.p. each. Besides this, the neighbouring roads were illuminated with 8000 c.p. and 3000 c.p. gas lights, and the Aoyama Palace was also brilliantly lighted by gas. As the Japanese Journal remarks, great convenience to all concerned was the result, and night was converted into day.

TEXAS COALS AND LIGNITE FOR GAS MAKING.

In the "JOURNAL" for the 23rd ult. (p. 963), we gave some extracts from a pamphlet, issued by the Bureau of Economic Geology and Technology of the University of Texas, on the subject of the fuels used in the State. We take from the same source the following additional particulars relating to the value of these fuels for gas making and the recovery of bye-products.

LIGNITE FOR MAKING PRODUCER GAS.

Lignite is used very largely for the making of producer gas; and the authors of the pamphlet (Messrs. W. B. Phillips and S. H. Warrell) give the chief points of interest in connection with this business. In a "Bulletin" issued by the University of Texas in 1911, there was a special chapter on "The Composition of Texas Coals and Lignites and the Use of Producer Gas in Texas," prepared by Mr. Drury M'N. Phillips, who was on the producer gas department of the South-Western States Portland Cement Company. At that time there were in the State 56 producers for making gas, and 47 were in active operation, representing 12,270 H.P. There were 27 establishments using Texas lignite exclusively, with a total consumption of some 180 tons per 24 hours, and a total engine horse power of 11,490. The authors do not consider it necessary to repeat the statistics gathered in 1911; so they merely give the items of chief interest, and then discuss briefly the conditions of the industry at the close of the year 1912. As the lignite area in Texas represents about one-half of the total known area in the United States, and as the production there is twice as great as from any other state, so the employment of lignite for making producer gas is largely in excess of such use in all the other states combined. Texas leads the entire country in area, production, and utilization of lignite.

So far as could be ascertained, the consumption of lignite in 1911 for making producer gas was about 180 tons a day. Several plants ran intermittently, so that it is not likely that the total consumption of lignite for this purpose during the year exceeded 50,000 tons. Allowing that a ton of lignite yields 50,000 cubic feet of gas in a producer, there would be 2500 million cubic feet of gas from the 50,000 tons. Allowing, further, that the heating value of this gas was, on the average, 125 B.Th.U. per cubic foot, there would be a total output of 312,500 million B.Th.U. for the year. This amount of heat would evaporate 32,000,000 lbs. of water from and at 212° Fahr. During the year 1912, the consumption of lignite in gas-producers was about 65,000 tons—a gain of 15,000 tons, or 30 per cent., over the returns for 1911. There is practically no recovery of bye-products in producer gas practice in Texas. At some of the plants the tar is burnt under auxiliary steam-boilers, and at others a little tar is used for creosoting telephone poles, &c. No tar is distilled, nor is there any attempt to utilize the ammoniacal liquor. It is not the custom to measure the gas, so that there are but few reliable statistics as to the yield per ton of lignite. One consumer reported the use of 32,898 tons during the year 1912, and said the yield was 69,000 cubic feet per ton. This may be in excess of the average yield; but the authors had no means of ascertaining whether or not it was so. For purposes of calculation, they preferred to take 50,000 cubic feet of 125 B.Th.U. gas per ton of lignite, and be on the safe side.

Considerable interest was taken in the establishment of a central power plant located at or near some of the lignite mines; and the matter was looked into carefully. The plans contemplated the erection of a modern producer gas plant, with recovery of bye-products, such as tar and ammonia, and the wiring of electric power to cities, towns, cotton-gins, irrigation installations, &c. From some of the lignites available, it would be possible to recover from 75 to 100 lbs. of sulphate of ammonia per ton; and this is worth from 2½ c. to 3 c. a pound, with a steady market all the year round. Allowing that the 65,000 tons of lignite used in gas-producers in Texas in 1912 could have yielded 50 lbs. of sulphate of ammonia per ton, which the authors consider a very reasonable assumption, the total value of this salt, at 2½ c. a pound, would be $81,250. The plant that used 32,898 tons of lignite could have recovered sulphate of ammonia to the value $39,122, and one that used 7600 tons, to the value of $9500; so that these two plants could have recovered $48,622 worth of this valuable material, all of which was lost. A central power plant, using 200 tons of lignite a day, could produce, in one year, sulphate of ammonia to the value of $136,875, to say nothing of the value of the tar and the products obtainable from it by distillation. Furthermore, these estimates do not include the value of the electric current to be got from generators operated by gas-engines.

As to the advantage of using producer gas, Mr. William Morey, jun., has, in an article on "The Gas-Producer" in "The Americana," stated the matter in an excellent manner. He says:

> The combined efficiency attainable in the best steam-engines and boilers, operating under the most favourable conditions, is about 12 per cent. of the intrinsic heat energy of the fuel used. On the other hand, the modern gas-engine, even in small powers, will give an efficiency much higher; but if it be supplied with illuminating gas for fuel a large amount of the economy due to the higher efficiency is lost in the cost of the gas. Heat energy in the form of coal gas at $1 per 1000 cubic feet, costs thirteen times as much as an equivalent amount of energy in the form of coal at $3 per ton. Therefore, in order to utilize a gas-engine to its full advantage, the gas used must be produced as economically as possible. This is exactly the function of the gas-producer; and by its use a good gas-engine with a theoretical thermal efficiency of 75 or 80 per cent., or a practical thermal efficiency of 25 or 30 per cent., will readily convert into actual work or available power 25 per cent. of the heat energy of the gas delivered to it. The gas-producer of such a plant will transfer to the gas about 80 per cent. of the intrinsic energy of the coal; so that a gas-producer engine operating on an inferior grade of coal will show an efficiency of 20 per cent., as against the 12 per cent. of a steam engine and boiler plant using the best steaming coal.

LOCATION AND COMPOSITION OF LIGNITE.

In the United States there are about 127,200 square miles of lignite territory; and the area in Texas is nearly half. The original supply of lignite may be taken to have been in excess of 30,000 million tons; and as it has scarcely been touched, the authors say "the supply of this fuel need occasion no anxiety for the next thousand years or so." There is found in Texas every known variety of lignite, from a material carrying but a small quantity of fixed carbon to nearly 45 per cent., and with from 30 per cent. to more than 76 per cent. of volatile combustible matter. Physically the lignites range from what is but little more than carbonized wood to a material almost like bituminous coal. In thickness, the beds run to 15 feet and more, and they are found from the surface to depths of 400 to 800 feet. In a general way, workable lignite is found in all that part of Texas lying east of the 97th meridian of west longitude, and north of the 31st degree of north latitude; but there are important areas outside of these boundaries.

Some analyses of Texas lignites carried out by Mr. Worrell in 1910-11 showed the following average composition:

	As Received.		Dry Basis.
Carbon	44·08	..	58·85
Hydrogen	3·35	..	4·48
Oxygen	16·49	..	22·20
Nitrogen	1·47	..	1·86
Heating power, B.Th.U.	7661	..	10,212

The authors state that the heat units in perfectly dry lignite compare fairly well with those in Texas coals as they are mined; but the units in lignite as received at points of consumption are much lower than in dry lignite and in coal. This point, however, is not covered in the "Bulletin." They have no means of knowing, except in a few cases, how much moisture lignites contain as they are used. In comparing one lignite with another, or lignite with coal for practical purposes, it is necessary to know how much moisture they contain; for upon this depends, to a great extent, their value as fuel. The following table shows how great the differences in composition of lignites may be, according as they are considered with the moisture they contain or on a dry basis.

	With 25 per Cent. of Moisture.		Dry.
Volatile combustible matter	37·59	..	50·48
Fixed carbon	28·45	..	37·81
Ash	8·79	..	11·71
Sulphur	0·65	..	0·90
Heating power, B.Th.U.	7,661	..	10,212

The percentages for any intermediate amount of water may be readily calculated from the "dry" analysis. In comparing one lignite with another, it is necessary to know how much water each contains, and what the composition would be if reduced to a dry basis. But since it is impracticable to dry lignite before it is used, and since it is customary to use it as soon as possible after it is mined, the amount of water it contains as it is used is a very important consideration. A case was reported to the authors in which the heating power of a certain lignite as received at the works was 6410 B.Th.U.; the moisture being 31·45 per cent. Theoretically, 1 lb. of this lignite should evaporate 6·63 lbs. of water from and at 212° Fahr. The returns reported an actual evaporative power per pound of 3·25 lbs. of water, or less than 50 per cent. of the theoretical power.

RECOVERY OF BYE-PRODUCTS FROM LIGNITE.

In order to determine the quantity and the nature of the bye-products obtainable from the destructive distillation of lignite, a sample was secured from the Texas Coal Company, Rockdale, Milam County. The percentage composition of this lignite was as follows:

	As Received.		Dry.
Moisture	29·83	..	..
Volatile combustible matter	35·46	..	50·50
Fixed carbon	27·03	..	38·50
Ash	7·98	..	11·00
Sulphur	0·88	..	1·25
Nitrogen	1·78	..	2·53

The distillation was made in a cast-iron vertical retort, placed in the furnace and covered over with coke, which was kept burning with a gasoline burner as needed. The products from the distillation were led into a water-cooled condenser, then into a wash-bottle, afterwards into dilute sulphuric acid, and finally through a tower filled with absorbent cotton. The gas was stored in a large tank. At first the heat was applied slowly. In about 20 minutes steam appeared in the condenser, and in 30 minutes a yellowish gas (tar vapour). During the first hour of distillation, about 14 per cent. of the total gases passed over, and the distillation was completed in about 2½ hours. The yield of gas was disregarded, since the amount, heating power, candle power, &c., had

already been determined. The results of four separate determinations are given below, in percentages.

—	I.	II.	III.	IV.
Residue from—				
Lignite, as charged	38·81	40·60	41·90	40·70
Dry lignite	55·44	56·38	56 62	55·75
Ammoniacal liquor	36·10	34·00	33·02	34·30
Total ammonia in raw lignite	0·85	0·63	0·84	0·71
Tar, raw lignite	6·90	7·40	7·87	10·10
Tar, dry basis.	9·86	10·28	11·04	13·83

The composition of the residue was as follows:

—	I.	II.	III.	IV.
Moisture	0·95	0·93	1·00	1 00
Volatile combustible matter	2·27	6 64	2·77	4·85
Fixed carbon	75·28	76·68	73·66	72·17
Ash	21·50	15·75	22·57	21·98
	100·00	100·00	100·00	100·00
Sulphur	1·54	1·45	1·48	1·36
Heating value, B.Th.U., per pound	10,708	11,287	10,224	10,462

It will be noticed that the ash content of I., III., and IV. is about the same. Residue No. II. had only 15·75 per cent. of ash; but in this particular case the lignite carried 8 per cent. of ash. It will also be noticed that the volatile matter in No. II. is 6·64 per cent.; showing that the heating was not carried far enough. The yield of ammonia in this case was also less, since the ammonia compounds require a high heat to break them up, and they are among the last products to come off.

During the distillation, about 10 per cent. of the lignite crumbled into dust. Lignite residue is dark grey in colour, glossy, slightly porous, hard, and has a clear metallic ring. There was no agglomeration of the particles, and no coking. The residue burns without flame or smoke, and has an average heating power of 10,500 B.Th.U. per pound. The yield of tar, as well as the nature of it, appears to depend on a variety of circumstances, such as the water contained in the raw material, the pressure in the distillation space, the size of the apparatus, the surface of its walls, the rapidity of the suction of the gases, and the temperature of the distillation, especially at the end of the process. Hence it is not possible to duplicate conditions very closely, particularly when one also considers the variation in the raw material itself. The tar has a specific gravity of ·865 at 72° Fahr.; it clogs at 60° Fahr.; and it is of butter-like consistency at 50°. The colour is dark brown, and the free carbon content (dust, residue, &c.) is 1·3 per cent. It was examined by fractional distillation for its content of oils, by cracking for the content of paraffin (about 8 per cent.), and by washing with alkali and acid for acid and basic content. The coke contained 7 per cent. of volatile combustible matter.

From a technical standpoint, three forms of ammonia may be obtained: (1) So-called "free" ammonia, which can be driven off from ammonia water and wash water; but the authors say it is doubtful if there is any free ammonia in such gases as they are now dealing with. (2) Combined ammonia, which can be made volatile by adding an alkali earth. (3) Ammonia which can be completely taken up by sulphuric acid only. In order to determine how much nitrogen contained in lignite is changed into ammonia, the third distillate was taken as a basis. The percentage nitrogen content was as follows: In dry lignite, 2·53; in tar, 2·82; in the residue, 0·18; in the gas, 4·90. Another way of stating this is as follows: 1000 parts of raw lignite with 26 per cent. of water give 18·72 parts of nitrogen, 419 parts of residue, 78·4 parts of tar, and 330 parts of water. The yield of gas in cubic feet per net ton is 7500. On this basis, a net ton (2000 lbs.) of raw lignite would contain as follows: Nitrogen, calculated as ammonia, 45·36 lbs.; residue, 838 lbs.; tar, 156·8 lbs.; water, 660 lbs.; gas, 300 lbs.

The nitrogen compound in the condensed water may consist of cyanogen compounds and members of the pyridine and chinolin groups. Of these compounds, 3·98 per cent. are in the coke, 6·46 per cent. in the tar, 9·30 per cent. in the ammonia, 45·50 per cent. in the gas, and 34·76 per cent. are unaccounted for.

The distribution of the nitrogen is quite different from that of other bituminous materials subjected to dry distillation. In the Scotch shales, 75 per cent. of the nitrogen is changed to ammonia by the use of steam; but in this case the carbon of the residue would be consumed. In the Texas lignite which the authors investigated, about 10 per cent. of the nitrogen was changed to ammonia; while in Saxony bituminous coal only 6·4 per cent. is changed, and in some English coal 10·8 per cent.

From a ton of lignite, there could be recovered 18 lbs. of sulphate of ammonia, worth 50 c.; and the surplus gas would be 3000 cubic feet. The authors think it should be worth 30 c. per 1000 cubic feet at the works—a total of 90 c.

The following statement includes the value of the bye-products to be obtained from a ton of lignite:

Residue from retorts, 800 lbs. at $3 a ton	$1·20
16 gallons of tar, at 5 c.	0·80
18 lbs. of sulphate of ammonia, at 3 c.	0·54
3000 cubic feet of surplus gas, at 30 c.	0·90
	$3·44

In order to arrive at an approximation of the value of the surplus gas when used to generate power in a gas-engine, the following calculation may be used: To guarantee 1 H.P. in an economically working gas motor, 10,700 B.Th.U. are necessary. One cubic foot of this gas has 387 B.Th.U., and 28 cubic feet are required for 1 H.P.-hour, or 1000 cubic feet are equivalent to 35·7 H.P.-hours. The 3000 cubic feet of surplus gas from the ton of lignite will generate 107-H.P.-hours, and the cost is about 1 c. per H.P.-hour.

[Other matter in the pamphlet will be noticed in a final article.]

SOUTH-WEST OF ENGLAND ASSOCIATION OF GAS MANAGERS.

The Association had a delightful summer outing last Thursday, thanks to the hospitality of Messrs. Willey and Co., Limited, of Exeter, who invited them to visit four of the works belonging to the Devon Gas Association. A large attendance of members, together with a few friends, including Mr. Harold W. Woodall (Bournemouth) and Mr. N. H. Humphrys (Salisbury), assembled at Exeter about 11 o'clock, and promptly discovered that an excellent itinerary had been arranged. A large electric motor char-a-banc, reinforced by private motor-cars, was in attendance, and after a cordial reception from Alderman Depree (the Chairman of Messrs. Willey and Co.), Mr. Glanfield, and Mr. R. J. Rew, a start was made for Chudleigh.

The gas-works visited were all excellent examples of the application of modern improvements to the very modest needs of residential towns of the smallest order. The principal characteristics were generator furnaces, ample condensing and scrubbing arrangements, exhausters driven by gas-engines, purifiers with luteless dry-faced lids, and Pickering's patent valves. Pressure-gauges and jet photometers are also the rule. The works are an excellent study for those who believe in the "unwholesomeness" of gas and gas-works. Every square yard of ground appears to be cultivated, and luxurious growths of flowers, fruit, and vegetables close up to the retort-houses, purifier sheds, &c., were matters of general remark.

After an instructive half-hour at the Chudleigh Gas-Works, the party proceeded *en route* for Buckfastleigh, passing through Ashburton, where a halt was called at the "Golden Lion"—a very comfortable hotel fitted with every modern convenience, but still retaining many of the old-world features so well described by Charles Dickens. Here a substantial luncheon was heartily appreciated. Alderman Depree presided, and was supported by the President of the Association (Mr. D. H. Lumb, of Chard), the Secretary, and Mr. Woodall. The time-table did not admit of a formal toast list; but Alderman Depree, in a few well-chosen words, expressed his pleasure at meeting the party, and gave some interesting particulars referring to the places visited. He proposed the health of the members of the Association and the visitors, coupling with the toast the President of the Association and Mr. Woodall, and mentioning that for the successful arrangements for the day's proceedings he was mainly indebted to the gentleman occupying the vice-chair—Mr. Rew.

The President and Mr. Woodall having briefly acknowledged the compliment, the party proceeded to Buckfastleigh. After inspecting the gas-works, they were shown over the grounds of Buckfast Abbey, where a handsome new church and cloisters in process of erection attracted much attention. Moreton Hampstead and West Brent were next visited; and the party returned to Exeter in time for the evening trains.

In the course of the day they covered some seventy or eighty miles of the romantic hills and dales for which the district is celebrated. The weather was all that could be desired; and a clear atmosphere enabled the full effect of the extensive views to be enjoyed. Those who had the privilege of accepting the hospitality of Messrs. Willey and Co. will not speedily forget their day in South Devon.

Particulars furnished to the members showed the progress that is being made by the Devon Gas Association. In 1906, the annual make of gas was 5,499,400 cubic feet, and the number of consumers 292; whereas for 1913 the figures had grown to 19,524,300 cubic feet and 1236 consumers.

High-Pressure Gas for the San Francisco Exhibition Grounds.—Telegraphing on June 23 to Mr. W. H. Gartley, the Chairman of the Joint Committee of the International Gas Congress, at San Francisco next year, Mr. E. C. Jones said: "It has finally been decided to install 300 high-pressure gas-lamps in the grounds of the Panama-Pacific Exposition. This will be an attractive feature of the exposition, and is a victory for gas."

Deformation of Water-Conduits.—Sig. C. Guidi, in an article in the "Accad. Sci. Torino" [Vol. XLVIII., p. 357], deals with the deformation of an iron tube having a wall thickness of 0·02 r or 0·01 r, where r is the radius of the tube. The conduit is assumed to be supported over an arc of 40°, offering a uniform resistance. The deformation is due partly to the hydrostatic pressure and partly to the weight of the water. If r is 100 cm., a tube 2 cm. (0·4 inch) thick shows very small deformations; but when the thickness is only 1 cm. the limits of stability are approached.

THOUGHTS AFTER MUNICH.

By "R. W. E."

"MULTUM IN PARVO." It was but a flying visit; and yet our hours on foreign soil were crowded with much that was profitable and much that was pleasurable. Such must be the general consensus of opinion of those who journeyed so far to join our German friends in their deliberations, and witness the opening of the splendid exhibition at Munich. From the moment we entered the precincts of the historic town until the train steamed out again, each agile minute seemed to leap to some fresh experience, some new point of view. "Travel is a part of education," said Bacon; and although he added, "He that travelleth into a country before he hath some entrance into the language, goeth to school and not to travel," we were all out to learn, and were much the better for the schooling. Our linguistic shortcomings were more than counterbalanced by the forethought and consideration of our hosts, and the more accomplished of our colleagues, as well as that prince of couriers, Mr. Fred. Wagner, in their assiduous efforts to banish any strangeness of atmosphere. "Small cheer and a great welcome makes a merry feast;" and there was nothing diminutive about the cheer that awaited us all, coupled with a hearty "Cead mille failthe." The height of their hospitality was reached when on the Friday evening of our stay, 1200 of both sexes, from all arts and parts, shared in a brilliant function, noteworthy not only for the culinary splendours, but also for the excellence of the speeches and the interim music.

But in the scope of this short reminiscence, it is not intended to enlarge on the social side of the programme, nor yet deal with the varied and thought-stirring papers read before the Association. It is good news that the latter are being epitomized for English readers in the pages of the "JOURNAL." Rather, the object of these lines is to catch something of the kaleidoscopic impressions most clearly left on the retina of memory.

The thoroughness of the German is almost proverbial; and "pushful perseverance" is the great bedrock of the nation's growing commercial prosperity. And the exhibition was the last word in thoroughness. On the manufacturing side, there was a comprehensive and most instructive section. Thanks to the wide gleanings of our technical journals the British engineer had some foreknowledge of what to expect, and the critical faculties were thus not overwhelmed by entire novelty of idea. As the home of the practice, interest naturally centred most in the Munich chamber ovens, and German practice in this respect was much enhanced by the visits paid to the gas-works. It was a very open-eyed party that availed themselves of the opportunity of studying the carbonizing methods in question; and undoubtedly they would be more widely adopted in this country were it not for the unsuitability of the coke for general domestic purposes. In particular manufacturing centres, where coke is largely utilized for other than domestic use, no such objection need, of course, arise. Further, with a due admixture of coke from (say) "horizontals" it was given forth with no hesitating voice, by one who should know, that householders' grievances are entirely overcome, and the dual product has a ready sale. As a result of the visit, we may hear more of "chamber carbonization" in our midst in the future. Each to his fancy. There were many other outstanding features in this section, but the exigencies of space prohibit further reference.

On the Distribution, or Sales, side, one found much food for fruitful reflection. Here again, the thoroughness of method and the nicety of detail were very evident. In October last, at the National Gas Exhibition at Shepherd's Bush, our eyes were opened, as never before, to the vast possibilities in the artistic exploitation of gas and the value of co-ordination and organization along definite lines. There may have been friendly "spies" in our midst on that occasion! Certainly what was, in a sense, theory to us then, or the cult of the few, is evidently the general practice in Germany now, and (one must confess) on a heightened scale at that.

COMBINING BUSINESS AND PLEASURE—"PUT THAT IN YOUR PIPE AND SMOKE IT!"

[A CLEVER SKETCH BY THE WELL-KNOWN ARTIST, MR. DAVID WILSON.]

The "German Frau" has ever been noted for her housekeeping capabilities; and, towards the making of the "Ideal Home," gas has, so to speak, been given to her as an Aladdin's lamp. Novelty of device, coupled with delicacy of detail, and over all the predominant idea of the right thing in the right place—everything seemed to work towards the artistic ensemble. In the field of gas-fires, and hot-water apparatus generally, there was nothing outstandingly striking or novel; and the home products on such lines need not have blushed in company. But in the "infinite variety" and in the daintiness of fittings—particularly in those fields where hitherto electricity has held almost undisputed sway—our German friends hold a key to many doors as yet closed to us. In truth, "our friend the enemy" must have a busy time holding his own abroad. Indeed, to visit this particular section—where fittings for every purpose and for all pockets were displayed—was like sipping practicality from the cup of the ideal. And the gas-cookers! Here one metaphorically bowed down, and looking so, in his mind's eye, saw the rut we in England have perhaps got into. Culinary comfort and the business of the kitchen a pleasure—that must be the German notion. Just a little addition here and an extra ledge there, facilitating convenience and economy, and they have an article that is a very fitting adjunct to the ideal kitchen.

In its company, man could not but acquire a dovelike habit; and no wonder the average German has a well-fed look about him. They know the secret of good cooking; and to find it one need not look beyond the cooker section at Munich. It stood out pre-eminently.

Such is a brief survey of the thoughts arising out of a visit fraught with many happy recollections. All told, the chief thing is: Gas is making great advances abroad, and if the information we garnered finds its equivalent in action at home, we will not have journeyed in vain. One cannot close, having in memory the pleasurable and instructive visit to Berlin of 1908 and the visit now reviewed, without expressing in the sincerest British manner to our German friends, "Thank you, and thank you again; and we hope you have benefited equally when visiting us here, and to your next visit we look forward with much pleasure, and promise to do you well in every way."

COMMERCIAL SECTIONS AND THE SALE OF COKE

By "Candid."

The past few months have severely tested the Commercial Sections, and the time is opportune for examining the position, and discussing the general question of the methods adopted in the sale of this important residual.

It must be granted at the outset that the condition of the market has of late been deplorable, and each responsible official has had to sell his coke for the best price obtainable, without too carefully considering the possible effect on his neighbours' prices. However, the primary object of the Commercial Sections should not be overlooked, which, as the writer understands, is to circulate information among the members, with the object of preventing the undue cutting of prices.

Take for instance the tendering for an important coke contract in Town A for which the local gas company is asked to quote. In fixing the price, the local official will take into consideration the price of coke in neighbouring towns, as given in the Commercial Section returns, and, after allowing for the railway rates, will fix his price at a lower figure, in order to secure the business in his own town—to which, it must be admitted, he has the prior right. Judge of his dismay when he learns that the contract has been secured (through a merchant) for B's coke, whose rail price is solemnly stated, in the Commercial Section returns, at shillings per ton more than the figure that has been quoted for this contract. It is hardly necessary to show that Town A, having lost the contract, has coke to sell somehow, and probably disposes of it at a low figure to be sent into the district of B and C; and so on indefinitely.

In the writer's opinion, this state of affairs is brought about either through a misunderstanding of the object of the returns, or from lack of candour on the part of the official who supplies the information.

The particulars given are doubtless correct as far as they go; and the yard price and current contract price may be quite satisfactory. But no mention is made of the spot lot of 500 or 1000 tons sold to a merchant at a cut-throat price; and it is this very figure which other members of the section desire to know.

It will be noted that the writer does not condemn the practice of selling spot lots at a low price; but he does deprecate the filling-in of returns which are misleading, and for all practical purposes worse than useless. At the same time he is bold enough to assert that spot-lot sales are often unnecessary, and that they are the principal cause of the ruining of the coke market almost everywhere.

Many officials seem to have a rooted objection to reducing their local price. They apparently think that to sell half their production locally at 20s. and half on rail at 10s. is better than selling the whole of it locally at 15s. These people forget that a lower price means an increased demand; and, if coke must be sold for less, why should not the consumers have the benefit of the whole of the reduction, instead of having to share it with the railway companies?

As an illustration of the effect of maintaining local prices, take the subject of steam-raising with this fuel, about which so much has been heard of late. Immediately a sale is sought in this direction, it becomes evident that the price must be substantially reduced, in order to compete with cheap slacks. One is then placed in the uncomfortable position of selling at (say) £1 to one consumer for greenhouse heating and at 15s. to his neighbour who uses it for his steam-boiler. Anyone who has tried selling at varying prices in a confined area can well imagine the results of this policy.

The consequence is that, in order to maintain a high local price, new business which requires low prices must be left alone; and as the coke must be sold somehow, it is sold cheap and dumped in some other town, to the detriment of the coke trade in general.

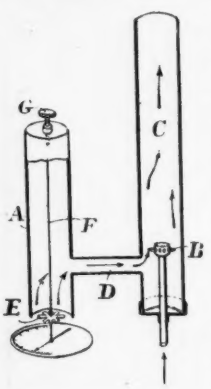
It is, of course, a fact that some districts produce more coke than can be consumed locally, while in others coke must be imported to supply the demand. But it ought to be possible, by co-operation, to move the fuel from the producing to the consuming centre without upsetting the market everywhere.

In this connection it is perhaps a pity that there is not a Coke Sales Association covering the whole country, because, even if the members of one section work together, their market is at any time liable to be upset by the incursion of perhaps a comparatively small quantity of coke from another part of the country.

A few hours could have been profitably spent in discussing the subject at the recent meeting of the Institution; and as this opportunity was lost, it is to be hoped that provision will be made for a full and frank discussion, *in camera*, at the "B.C.G.A." meeting. Certainly this transcends in importance any subject gas managers can discuss at the present time; and it would be a little relief from the usual atmosphere of "mutual admiration" to "see the feathers fly," and to hear some of the things spoken in public conference which are being freely whispered in private conversation.

A FÉRY GAS-CALORIMETER.

A French patent has been taken out by M. Charles Féry for an apparatus for measuring rapidly and recording the calorific power of gas employed as fuel. In principle it consists in determining the heat units given off by the ascensional power communicated to the products of combustion—that is to say, by the draught set up in a chimney wherein the combustion of the gas or other fuel of which the calorific power is to be measured takes place. This chimney draught is utilized to produce mechanical action, such as the angular deviation of a wire, with a pointer hanging from its lower end, over a dial marked with a scale, or the displacement of a lever with a small counterweight.



The accompanying diagram shows a form of the apparatus. B is a "rose" burner so constructed as to avoid the suction which would be produced by a vertical jet of gas. The hot gases ascend in the chimney C, producing a draught through the horizontal tube D, connected with a second vertical tube A, which contains the measuring apparatus. This could be placed in the lower part of the chimney C; but it might become heated, and this would falsify the indications, as the coefficient of torsion of wire varies greatly with temperature.

The measuring instrument consists of an anemometer moulinet E, suspended by a torsion wire F. The moulinet, with oblique blades working like a screw, does not rotate, but is moved with an angular displacement under the influence of the draught of air when the action is equilibrated by the torsion wire, and this torsion is manifested by the angular displacement of the hand on the dial. The wire can be regulated from the outside by means of the knob G, and thus the hand can be brought back to the zero point when the instrument is cold, and before commencing measurement.

As soon as the gas is ignited, the moulinet begins to turn, and the hand assumes a position of equilibrium, which measures the velocity of the gaseous current. This is proportional to the calorific power of the gas. The apparatus can be standardized with gas of which this power is known—for example, hydrogen (2470 calories) or acetylene (13,400 calories). It is advisable to insulate the chimney C to prevent loss of heat; the whole of the calories produced having to be carried forward by the products of combustion.

In the case of the measurement of the calorific power of gas, the volume burnt per unit of time should be known. Thus the calorific power can be recorded as a function of time, when care is taken to feed the calorimeter with a constant delivery by means of a regulator. The indicator hands of the measuring instrument can move on a revolving recording drum, and thus the working during a longer or shorter period can be verified.

The Transfer of the Birmingham Gas Undertakings.

In connection with the transfer of the Birmingham gas undertakings to the Corporation, to which reference was made in the notice of the death of Mr. Joseph Chamberlain appearing in the "Journal" for the 7th inst., it may be of interest to recall the circumstance (which will doubtless be in the recollection of many of our older readers) that Mr. Robert Jones, the father of Mr. H. E. Jones, acted for the Corporation in this important matter. He was frequently in communication with Mr. Chamberlain and Mr. Hayes, who was Town Clerk at the time, and with whom he had had many previous transactions. He investigated the condition of both undertakings in 1874, and on the basis of his valuation, which was furnished privately to the Town Clerk, Mr. Chamberlain bid for them at their dividend prices. When the Bill of the Corporation was before Parliament in 1875, Mr. Jones gave evidence, and expressed himself in favour of the transfer, believing it would be advantageous in several ways. He was at the time Engineer-in-Chief of the Commercial Gas Company, and, curiously enough, they had in the same session a Bill which was under consideration at the very time when the Birmingham Bill was in Committee.

HEATING BY GAS.

The "Journal für Gasbeleuchtung" for the 11th inst. contains the full text of the paper on this subject presented by Dr. KARL BUNTE at the recent meeting of the German Association in Munich. The following are some of the chief points it contains.

Without a doubt, gas is an ideal means of heating. Its cleanliness, easy application, and regulation, and its complete smokeless and sootless combustion, have already assured it a place as a means of cooking and water-heating. If it has not, till recent times, been able to make equal progress in domestic heating, some other obstacle besides cost must be sought, considering the invaluable advantages that it offers. Since modern gas-stoves attain an efficiency of 85 to 95 per cent., there can be no question as to their economy. Therefore those interested should set out to discover what is needed to make the gas-stove perfect in every way for its purpose.

QUESTIONS OF COST.

The cost of heating entirely by gas has often been discussed; and it has been shown that, with gas at about 2s. 8d. per 1000 cubic feet, it is somewhat more expensive than central heating. Central heating, too, has been shown to be more expensive than ordinary stove heating; so that gas must be considered as among the more expensive methods of heating. As a matter of fact, it has been considered as too expensive to be practical, and too practical to be ornamental. This is still the case to a certain extent.* The point as to whether the general introduction of gas-heating is a paying proposition for gas-works is dealt with by Herr Göhrum [see "JOURNAL" for July 7, p. 27]. Perhaps the interest of gas producers is best served by selling gas for heating mainly between the extreme seasons, and for rooms which are only in occasional use. But these gas-stoves must be made somewhat different in their outward appearance and in their working to those which are used for constant heating.

SPECIAL TYPES FOR SPECIAL CIRCUMSTANCES.

Stoves for heating rooms which are only needed occasionally, or for short periods—such as spare-bedrooms, bath rooms, &c.—must be of simple construction and pleasing appearance. But it is just these cases which demand rapid heating, without the stoves needing any particular cleaning-up before use. Preliminary or supplementary heating of better-class offices, dwelling-rooms, or social premises demands different considerations. Only in the rarest cases will a place be found specially provided for a gas-stove, as well as the elaborate systems of stoves or central heating planned by the architect. The gas-stove, to find a place here, must be unobtrusive and attractive in appearance.

HYGIENIC CONSTRUCTION.

A most important point in connection with gas heating is hygienic efficiency. One of the chief considerations in its favour is the elimination of the smoke and soot nuisance. The progress of the gas-stove in London, and the displacing of open coal-fires, has already led to considerable improvement in the atmospheric conditions of the city. But, in order to receive the full support of hygienists, attention must be paid to the working of the stove itself. The escape of the products of combustion, and the consequent increase in carbon dioxide and water-vapour content of the air of the room, must first of all be avoided. One great advantage of gas over solid fuel is that attention can be concentrated on constructing the flue to pass away all products of combustion, since it is not needed for the production of an artificial draught. Above all, any possibility must be avoided of the combustion products being driven back again into the flames even if any unforeseen disturbance occurs in the chimney—a condition which is fulfilled in almost all modern types. Gas has also the great advantage over solid fuel that combustion can be so regulated as to leave no harmful products (above all no trace of carbon monoxide) in the waste gases; so that, even if they escape into the room by accident, no great harm is done. Hygienists have in the past reproached gas-stoves with causing unpleasant smells both when first lighted and after burning for some time. This has been due to faulty construction, that permitted the collecting of dust, which, in contact with the flame, occasioned the mischief. It is now up to the makers to wear-down this evil reputation. It is not sufficient that cleaning of the parts be made possible. Remember that there is no intrinsic reason why an oil-stove should necessarily smell when in use; but it is seldom that one is met which does not do so. The right principle upon which to work is not to avoid the possibility of the heating parts becoming dirty, but to avoid the heating of dusty parts of the stove. Further, care must be taken that particles of dust introduced with the air are not over-heated. A good test for this is to rub together two pieces of felt in front of the stove, the dust from which causes a distinctly unpleasant smell when over-heated. Far behind these considerations—suitability of type, hygienic efficiency, and convenience—in importance comes the question of the heating efficiency of a gas-stove.

HEATING EFFICIENCY.

The heating efficiency of gas-stoves is generally very high, and has the advantage of being quite independent of the method of use, which is not the case with other methods of heating. It reaches commonly to 60 or 70 per cent., and even to 85 or 95 per cent. with purely radiating gas fires. The determination of the heating efficiency is easier than with other methods of heating, because the only source of loss is in the products of combustion, and it is all the easier in that there is no question of unconsumed gas, and no smoke and similar losses. With all this simplicity, it seems that gas undertakings should do far more testing than is generally the case. The quantity of dry products of combustion is determined by finding what quantity of carbon dioxide is produced by the combustion of a unit quantity of gas; also what quantity of carbon dioxide passes off in the waste products, and hence what total quantity of waste products is passed off per unit volume of gas consumed. This last quantity is then multiplied by its heat capacity and by the mean increase over the temperature of the room. This gives the loss in heat units per unit of gas consumed, which is compared with the net calorific value of the gas, in order to find the loss in the dry products of combustion as a proportion of the total heat units introduced in the gas. The loss due to water vapour must also be reckoned with. This is dealt with later on. Several points need attention. First it must be ascertained whether all the products of combustion pass off through the flue; for this test is not accurate unless they contain all the carbon dioxide produced.

The author then describes the "Shadowgraph" test and the "Lancet" test, both of which are too well known to English gas engineers to need more than passing mention here. No stove, says the author, should be tested by this method for its heating efficiency until it satisfies the condition that all products of combustion pass away through the flue-vent without being connected to a chimney.

Both hygiene and economy also demand complete combustion of the gas. The author recommends Brunk's method for detecting carbon monoxide in the waste gases, which depends on the separation of metallic palladium from a solution of palladium chloride. Almost all the stoves tested showed, with a carbon dioxide content of 4·5 to 5 per cent. in the products (*i.e.*, with about a 2 : 1 proportion of air), an inclination towards a trace of carbon monoxide. It is at first surprising, remarks the author, that this inclination is less pronounced with the heating of fire-clay radiants than with a plain illuminating flame. He attributes this to the fact that the heat of the radiants is sufficient to ignite any traces of carbon monoxide that have escaped the heat of the flame. It is well-known that a pointed or swallow-tail gas-flame is apt to form soot, and where soot is found as a product of incomplete combustion, there carbon monoxide is also to be expected. In testing the quantity of carbon dioxide in the flue gases, exact determinations should be made every five minutes for an hour, and the average taken.

WATER VAPOUR.

So far, only dry combustion products and their calorific value have been considered. In many cases this is quite sufficient, as, for instance, when only the approximate heating efficiency of a stove is required to be known, or a simple comparison is needed between a radiation and a convection stove, and, above all, when the efficiency is to be taken for the determination of the hourly heating capacity of a stove. But where exactness is of importance, the moisture in the combustion products must not be lost sight of. This is derived from various sources—from the combustion of hydrogen and hydrocarbons or else from the gas itself. The latter is of little importance. It has been shown that gas is saturated with water vapour after passing through a wet meter. But the quantity which passes from a wet meter to the flue products amounts at 20° only to 21·15 litres per cubic metre (2·115 per cent.), which at 300° C. would only have a heating value of 2·5 calories, or about 0·05 per cent. of the calorific value of the gas. This source of error is therefore negligible. Similarly, if air is used for the combustion of the gas in the proportion of 15 : 1 (three times as much as is necessary), the loss in heat units due to water vapour derived from the air of combustion will only amount to 0·3 per cent. of the calorific value of the gas—assuming again the high flue temperature of 300° C. As the water vapour contained in the flue gases is a constant quantity for the same gas of the same calorific value, it is best accounted for by a simple addition to the loss already determined for dry products of combustion.

For this purpose the author has compiled a table, in which is given the heat value of the water vapour contained in the flue gases, expressed in calories per cubic metre of gas consumed and also as a percentage of a heating value of 4800 calories. [Though the units given are not those generally used in England, the table may be reproduced as an example.]

Heat Content of the Water Vapour.

Water Vapour per Cubic Metre of Gas Consumed.	In Calories at			As Percentage of the Net Calorific Value of the Gas, 4800 Calories.		
	100° C.	200° C.	300° C.	100° C.	200° C.	300° C.
0·9 cbm.	33·5	69·5	107	0·7	1·45	2·25
1·0 ,,	37·5	77	120	0·75	1·60	2·50
1·1 ,,	41	85	132	0·85	1·75	2·75
1·2 ,,	45	93·5	144	0·95	1·95	3·00
1·3 ,,	48·6	100	156	1·00	2·10	3·25

* These comparisons do not apply to English conditions, as the gas reflector stove, the German coal-stove, and central heating are little seen in English houses.—ED. J.G.L.

Each gas undertaking would only have to compile one such table, since the same gas always gives the same quantity of water vapour. But the determination of efficiency with an allowance for losses due to water vapour is often too complicated for the ordinary gas-works laboratory, and the simpler calculation is generally enough.

From the efficiency and the gas consumption is reckoned the number of heat units that a stove gives per hour. This figure is little affected by slight alterations in the calorific value of the gas, and a difference of 1 or 2 per cent. in the heating effect of the stove can make no difference in the size selected for any particular room. A point that is only too frequently lost sight of is that rooms of equal cubical content do not always need stoves of equal heating capacity—the situation, number of windows, &c., must be taken into consideration. One advantage of gas heating, as compared with central heating, must not be forgotten, and that is the ventilating effect of a gas-stove, due to the drawing-in of the air necessary for the combustion of the gas, as shown by these figures:

Percentage of CO_2 in the flue gases	1	2	3	4	5	6
Quantity of air passing through the stove per unit of gas consumed .	50	25	16·6	12·5	10	8·51

In this connection it must also be considered whether the amount of heat required for comfort is the same with gas-stoves as with other forms of heating. For instance, it is well known that the economy of gas heating for churches depends on being able to raise a large amount of heat with a good number of stoves in a short time; so that the actual quantity of heat required is less than with smaller stoves burning for a longer period.

Dew-Point.

According to the estimate of Butterfield, the dew-point of the flue gases—*i.e.*, the temperature at which water separates out—is about 25° C. with a carbon dioxide content of 1 per cent., and 45° C. with 4 per cent. of carbon dioxide. With theoretical combustion, without excess of air, the dew-point would be about 65° C. This, of course, may lead to condensation in the flue-pipe, for which provision must be made when necessary. The separation of water from the flue gases can have yet another consequence. Water vapour is lighter than air, and so increases the draught in the flue, which is dependent upon the specific gravity of the combustion products. Professor Junkers has published a graphic representation of the specific gravity of flue-gases with 5·5 per cent. of carbon dioxide for various temperatures, compared with air at 15° C. The curve shows a break at the dew-point; and from this point downwards the specific gravity increases more rapidly, and the draught decreases proportionally, but remains positive against dry air down to a temperature of about 10° C.

Convection and Radiation.

There are, the author points out, two methods of heating by gas. One is to heat the air of the room almost exclusively by convection; the other is to radiate the heat by means of incandescent bodies. Referring to the former method, he says the principle upon which it should be worked is not to raise small quantities of air to high temperatures, but to warm large quantities to the degree required. Radiating gas-fires have been introduced into Germany from England and France, where the open fire-place has so long been a prominent feature in home life. It is comparatively easy for the gas-fire to displace the open coal or wood fire, with an efficiency of 6 to 30 per cent., for the latest patterns of gas-fire have an efficiency of 60 to 70 per cent.

Opinions differ considerably on the subject of the hygienic aspect of these radiating gas-fires; and it is really rather a question of custom than of hygiene. Perhaps some method will come to light of really testing exactly the relative effects on the breathing, pulse, temperature, and general health of the human being of heating by convection or by radiation. Be it remarked, however, that heating by radiation has a good chance of an opening in Germany, because the German generally finds interesting, and is not unwilling to adopt, strange customs, if offered to him in suitable form. The purely radiating fires, as made by English firms, mostly need at any rate a short length of flue-pipe, in order to avoid the slight tendency towards the escape of combustion products. But the latter are absolutely free from carbon monoxide, so long as the fire is not overworked. The efficiency of those tested has been as much as appreciably to 77 per cent. without chimney draught, and the flue gases pass off at a temperature of from 170° to 190° C.

Attempts have been made to utilize this waste heat, by introducing into the flue a recuperator. This has had the effect of raising the efficiency to 94 per cent., and reducing the temperature of the flue gases to 100° C. But the latter show traces of carbon monoxide, and are apt to escape if there is no chimney draught. The Gasgesellschaft Berlin has found another means of utilizing the waste heat, by surrounding the stove with tile-work, which conceals ducts for the hot gases, around which the air can circulate. The surface of the tiles does not become sufficiently warm to overheat any dust that may have collected.

A few general words on gas-heating as compared with other German systems follow, and the author concludes with an exhortation to the gas industry to watch, with the greatest care, that only such systems find their way to the market as fulfil all æsthetic, hygienic, and economic requirements.

ANALYSIS OF ILLUMINATION SYSTEMS.

At a Meeting of the Research Committee of the American Illuminating Engineering Society, a discussion took place on the analysis and classification of illumination systems. The Chairman of the Committee (Dr. Herbert E. Ives) presented the following report on the subject, and it appears in No. 4 of the Society's "Transactions" for the present year.

The subject was considered chiefly from the standpoint of laboratory analysis, having in mind the physical factors which should be regarded by the physiological and psychological investigator of lighting problems. Into what fundamental factors can an illumination system be resolved for study, and how shall these be measured and recorded in order that the exact working conditions may be understood or duplicated? Following this analysis, considerable time was directed to discussing definitions of "direct and indirect lighting systems." The scientific analysis of a lighting system is completely given by a record of the intrinsic brilliancies of all objects visible from the position chosen for test, and by the components of illumination at all points. For an absolutely complete description of the lighting conditions the number of measurements would be very large. In any given case, by attention to the more significant points and the exercise of judgment the number may be greatly reduced. Also, while every factor is actually given by these data, a more concrete idea may often be obtained from more obvious characteristics, such as the general direction of the light, the area of the principal light source, whether it is visible or invisible to the observer, and in other cases by the commercial specifications.

Intrinsic Brilliancy, or Candle Power per Unit of Area.—A complete plot of the intrinsic brilliancies of all visible areas constitutes a picture of the image thrown upon the retina. In many cases this gives all the necessary information. These measurements should be plotted upon a dimensioned drawing or, even better, upon a photographic print. All points cannot, of course, be so given; but special attention should be paid to the extremes, to the bright light sources and to their backgrounds, to the adjacent spaces of greatly different brightness. The method of making contour maps by the surveyor might be taken as a guide to what is called for here.

Components of Illumination.—The number of components of illumination at a point is infinite, and the number of points and planes upon which measurements can be made is also infinite. In any given case the points or planes of chief interest must be selected and the illumination components determined in the smallest number of directions which will give an adequate idea of conditions. Thus in much illuminating engineering work the horizontal plane 30 inches above the floor is chosen for measurement, as being desk and table height; but other planes often figure, as in library lighting, where the plane of the bookcase is of chief interest. The number of components to be measured is determined by the kind of test or work. If the test involves only flat surfaces, such as print, the measurement of intrinsic brilliancy or of normal illumination is sufficient. If relief surfaces, such as type, then the direction of light becomes significant. In any case the greatest number of components likely to be of interest at the point of work is nine—viz., vertical, four at 45°, and four horizontal.

As to the other factors actually covered by these measurements, but capable of supplying significant information immediately, some are in greater detail, as follows:

Visibility of Light Sources.—The illumination of the floor and lower part of the room by daylight is frequently from a part of the sky not visible to the occupants of the room. The illumination of a working plane may be entirely unaffected by the interposition of a shade between the light source and the observer; but the visibility or invisibility of the illuminant is of interest to the worker. Consequently the concealment or visibility of the light source is a significant factor and is very easily recorded. By "light source" must be understood, in illumination science, not alone the original illuminant, such as the flame or filament, but the surface from which the light comes, whether by emission, diffuse reflection, or diffuse transmission, which illuminates the point of study. Thus the bright ceiling used with an indirect unit is the light source to be considered in discussing visibility or concealment, not the lamp in the fixture.

The terms "primary" and "secondary" light source may be used, if desired, to distinguish between the original illuminant and the reflecting and transmitting accessories which as well illuminate the point of study.

Area of Light Source.—The character of the shadows and the relative value of different components of illumination are conditioned largely by the angle subtended by the principal light source. The mere statement that the light sources are practically points (as with bare incandescent lamps) or areas of several square metres (when a bright ceiling is used) is of value.

Direction of Light.—Usually the light falling on the working plane comes largely from a definite direction from above or from one side. Since certain kinds of detail are revealed by one direction of light over another, this is a factor of importance. Aesthetic values are affected to a marked degree by the direction of shadows, and as a consequence the general impression produced on an observer is dependent on the direction of light.

Dimensions and Commercial Specifications.—No details of dimen-

sions or position which are necessary for the complete picturing of conditions should be omitted. The use of commercial specifications of illuminants, auxiliary apparatus, and illuminated surfaces frequently saves much time; but it must not be forgotten that such specifications are apt to be of significance only locally and for a limited time. The legitimate use of photographs with dimensions to show details of shape and position, and of photographs on which measurements of surface brightness are marked to show brightness distribution, is to be encouraged.

The suggestion is made that investigations of lighting conditions from the standpoint of physiology and psychology, the study of methods of tests for effects upon the eye, &c., should be initially made upon the simple component factors which in combination produce all the retinal images presented by illuminated spaces. The study of the effects of observing surface brightnesses, of different areas, in various positions, presenting various contrasts in brightness with their surroundings and at different distances from the observer, will, if consistently planned, furnish the information from which the effects of complex lighting installations, present or future, may be determined, by proper test method. Information founded upon this analysis should as well point the way to different and improved methods of lighting in the future. As an assistance to the work of representing results on photographic prints, the study of photographic processes with a view to developing a set of specifications as to processes and materials so as to render possible faithful and useful photographs, is recommended.

The subjects of so-called "direct" and "indirect" lighting were next discussed, and the opinion developed that these terms properly described lighting "units" rather than lighting "systems." As describing systems, the terms are incomplete, and are not based upon the significant factors which, as indicated above, are the area and intrinsic brilliancy of the light source, its visibility or concealment, and the general direction of the light flux received on the working plane. It developed on discussion that two lighting systems exactly the same as regards directional values, intensity, &c., might in one case be direct and in another case an indirect system. Also cases would arise where direct lighting is accomplished by indirect or semi-indirect fixtures. In this connection weight must be attached to the fact that popular usage and understanding of the terms "direct" and "indirect" is attached to the fixtures themselves. Weight must also be given to the fact that the really significant features—such as the softness of the shadows, concealment of the illuminants, &c.—which are characteristic of one so-called "system" may readily be copied by another. It, therefore, appears to the Committee inadvisable for the Society officially to attach the terms "direct" and "indirect" to systems of illumination, but rather to lend its weight to the application of these terms merely to the units. By so doing it should leave the way clear for more thoroughly considered terms for describing lighting "systems," if any simple terms can indeed be found to classify in a significant manner all the possible combinations of simple factors.

As a basis for definitions of "direct," "indirect," and "semi-indirect" lighting units, the Committee suggests the following, abstracted from a paper by Mr. A. L. Powell:

> *Direct Unit.*—A lighting device from which over half the emitted light flux is directed downward, or to the side, reaching the surface to be illuminated without being reflected by the walls or ceiling.
>
> *Semi-Indirect Unit.*—A lighting device employing a diffusing or translucent medium to direct most of the light to the walls or ceiling to be redirected for use, a part of the light being diffused through this medium.
>
> *Indirect Unit.*—A lighting device from which all the light emitted is projected to the ceilings or walls, and then reflected to the object to be lighted.

It is not expected that these definitions will cover all possible types which may be developed. It must not be forgotton that the only complete specification of a lighting unit is by its candle-power distribution curve, its dimensions, intrinsic brilliancy, &c. The same unit may be direct or indirect, depending upon whether it is turned up or down, so that these definitions are strictly of the *unit as used*.

A partial bibliography of the subject is appended to the report.

Speed of Ignition of Gases.—A German patent [No. 272,705 of 1913] has been taken out by M. Hofsäss for apparatus for determining the speed of the ignition of gases by measuring the inner cone of the flame. According to an abstract of the specification in the current number of the "Journal of the Society of Chemical Industry," the gas is burnt in a bunsen burner connected at its lower end with a pressure-gauge and a regulator for ensuring a constant pressure, and at its upper end with a device whereby the height of the inner cone of the flame can be measured or recorded photographically. The supplies of gas and air are so regulated that the inner flame has approximately the shape of a right cone, the surface of which is directly proportional to its height. The speed of ignition of the gas is equal to the quotient of the velocity at which the mixture of gas and primary air is supplied to the burner and the surface of the inner cone of the flame. For example, under similar conditions, the surface of the inner cone of a carbon monoxide flame is about six times that of the inner cone of a hydrogen flame; the speed of ignition of hydrogen being six times greater than that of carbon monoxide.

SOCIETY OF CHEMICAL INDUSTRY.

Annual General Meeting at Nottingham.

The Thirty-Third Annual General Meeting of the Society opened at Nottingham on Wednesday last, and was attended by about 150 members. The meeting was formally opened in the large theatre of the University College on Wednesday morning by the President of the Society, Dr. Rudolf Messel, F.R.S.; and the members were welcomed to the City by the Mayor of Nottingham, Mr. Frederick Ball, J.P.

The report of the Council stated that the Society's medal had been awarded to the Rt. Hon. Sir Henry Roscoe, F.R.S., for his services to science, education, and to the Society. It had been hoped that Sir Henry Roscoe would have been present to receive the medal; but a telegram and letter from him were read in which he expressed great regret that he was prevented by ill-health from coming to Nottingham, and concluding by wishing the Society (of which he was the first President) continued success and prosperity. Sir William Crookes, O.M., had been elected President of the Society at last year's general meeting; but being subsequently elected President of the Royal Society, he had felt himself obliged to resign the former office, and the Council had elected Dr. R. Messel, Past-President, to act until the close of the session. Sir William Crookes had, however, prepared a presidential address which he had hoped to deliver in person at the meeting; but at the last moment he had found that his health would not allow him to fulfil this engagement. His address was read on his behalf by Dr. Messel, and extracts from it are given later on.

Dr. Messel offered a few observations on Sir William Crookes' address, pointing out that the inception of catalytic processes was largely due to the work of the latter, who, since his British Association address in 1898, was generally regarded as an alarmist because he drew attention to the rapidity with which the world's consumption of wheat was overtaking all ordinary sources of supply. But if Sir William Crookes was an alarmist, he was also prepared to supply the remedy; for in 1892 he had shown flames of burning nitrogen, and had pointed out in his 1898 address that, even by then known methods, power obtained from Niagara at one-seventeenth of a penny per B.Th.U. could produce nitrate of soda for not more than £5 per ton. Now the nitrogenous fertilizers essential to the continuance of an adequate wheat supply were being obtained from the atmosphere in the heart of Germany, where neither power nor labour was cheap. Dr. Messel regretted that there were no signs that the synthetic production of nitrogenous fertilizers, for which Germany possessed no natural advantages over us, was being taken up in this country.

Among messages of regret for inability to attend the meeting was one from Mr. C. Carpenter, D.Sc., who is one of the Vice-Presidents of the Society. As the result of the ballot for the election of four ordinary members of Council to take the place of those retiring by rotation, it was declared that Mr. J. H. Coste, F.I.C. (Chemist to the London County Council), Professor R. F. Ruttan (Past-Chairman of the Canadian Section of the Society), Mr. A. Gordon Salamon, F.I.C. (Hon. Treasurer of the Institute of Chemistry), and Mr. J. T. Wood, of Nottingham, had been elected. Mr. J. Hübner, on behalf of the Manchester Section of the Society, invited members to hold next year's general meeting at Manchester in September, about the time of the meeting of the British Association in the city. The invitation was accepted with acclamation. The report of the Council concluded with the statement that a Committee has been appointed to report to the Council on means for increasing the membership and usefulness of the Society, and that several valuable suggestions have been received which are still under consideration.

The President announced that the Council had received with great regret from Mr. Watson Smith, who had been Editor of the Society's "Journal" for the past thirty-three years, a letter tendering his resignation of the position at the close of this year, on the ground that, having reached his seventieth year, he felt unable owing to advancing years and failing health to do justice to the work it involved. The statement of accounts showed that the Society's financial position continued to be very good. The certified value on Dec. 31 last of their investments, which had cost the Society £19,648 17s. 1d., was, owing to depreciation in the value of securities, only £17,349 18s. 5d., but the dividends were, of course, unaffected. The business meeting closed with the customary votes of thanks.

Those attending the meeting were entertained at luncheon at the Victoria Hotel by the Nottingham Section of the Society. In the afternoon a visit was paid to Southwell Cathedral; and this visit was followed by a garden party given by Mr. and Mrs. W. N. Hicking at Brackenhurst Hall. In the evening, there was a reception at the Castle by the Mayor of Nottingham.

Thursday morning was devoted to visits to works at Nottingham and Derby. In the afternoon, Sir John Turney gave a garden party at Gedling House; and the annual dinner took place in the evening. On Friday there was a whole-day excursion to the Dukeries; and in the evening a reception by Sir Jesse Boot.

Among the works thrown open to inspection by members during the week were the Nottingham Corporation Gas and Electricity Works. Some particulars of the plant and output of these works were given in a *brochure* which was handed to those attending the meeting. The present price of gas is from 2s. 2d. to 2s. 4d. per

1000 cubic feet, with a reduction to from 1s. 6d. to 1s. 10d. for gas supplied for power purposes. Last year 192,927 tons of coal and 108,155 gallons of oil were used for gas making, and the gas sold was 2,168,651,700 cubic feet, which is an increase of 5·78 per cent. on the previous year. The quantity of gas sold per ton of coal carbonized has risen from 9549 cubic feet in 1904 to 11,059 cubic feet in 1913. In 1904, the gas undertaking provided £28,300 in aid of the rates, and in 1913, £39,000. The consumption of electricity in 1912-13 was 12,602,306 units, of which 5,761,096 units were for the Corporation tramways. The average price paid for current in 1913 was 1·79d. per unit, but nothing is said as to allocation of profits, if any, in relief of the rates.

PRESIDENTIAL ADDRESS

Of Sir William Crookes, O.M., President R.S.

The Presidential Address was, in the absence through illness of the author, read by Dr. R. Messel, F.R.S., who has consented to fill the position of President, which Sir William Crookes was compelled to resign on election to the presidency of the Royal Society. Sir William remarked that his regret at parting was greatly tempered by the reflection that in Dr. Messel the Society would have a President of pre-eminent suitability and unrivalled qualifications. Dr. Messel's knowledge of industrial chemistry, and his close connection and acquaintance with foreign manufacturing practice, would be of great value to English chemists.

Proceeding, Sir William remarked that technical chemistry made great strides, and that the past year had seen the publication of results which, though perhaps not sensational enough to stir public imagination, nor intrinsically important enough to be described as epoch-making, were a sufficient tribute to the steady industry of investigators, to their resource in overcoming difficulties, and to their acumen in elucidating the casual relations of some particularly interesting phenomena. Some of the work done, and to which he then went on to refer, is of special concern to "Journal" readers; and these portions of the address are reproduced in the author's own words.

Production of Ammonia.

Foremost I must mention Haber's process for the production of ammonia. Ammonium sulphate is now synthesized by the Badische Company, who are about to enlarge their plant (by the end of 1915) to a capacity of 130,000 tons per annum. The catalyst osmium has been replaced, first by uranium, later on by Fe_2O_3. The investigation of the process has shown that the latter catalyst is made more active by the addition of certain substances—*e.g.*, oxides, hydroxides, and salts of alkali metals—while other substances (such as arsenic) act as specific poisons towards ammonia catalysts.

Nitrogenous Products.

The demand for nitrogenous fertilizers steadily advances. There is also an increasing demand for nitrogenous products for industrial purposes; concentrated nitric acid being one of the most important of all these products. The Norwegian Hydroelectric Nitrogen Company, Limited, among others, have worked out a simple method of obtaining dilute nitric acid by the oxidation of atmospheric nitrogen, and then concentrating the dilute acid by making use of the hot gases of the furnaces. The concentrated acid can thus be very cheaply obtained. The output of the Company's works at Rjukau and Notodden has now reached—

80,000 to 90,000 tons of nitrate of lime.
10,000 tons of nitrate of soda.
5000 to 6000 tons of refined nitrate of soda.
15,000 tons of nitrate of ammonia.

Antiseptics for Soils.

The work of Dr. E. J. Russell and others on the action of antiseptics on soil in increasing the growth of crops has led to deeply important results. The anomalous effects of the partial sterilization of the soil in causing first a fall and then a rapid rise in the number of bacteria were first observed. Further study showed that the increased productiveness of partially sterilized soil is due to the increased production of ammonia, and that the increase in bacteria is the result of an improvement of the soil as a medium for bacterial growth. From the experiments, Dr. Russell concludes that ordinary soil contains a factor which limits the bacterial population, and prevents its reaching its maximum. The action of different antiseptics has been studied, and interesting conclusions drawn from the work. It is found that there is a decided difference in the action of different antiseptics; and only actual trial will decide which may be best in special cases. Generally speaking, formaldehyde and pyridine are the most useful for "sick" soils; cresol, phenyl, &c., coming next; while the higher homologues of benzene are the least effective. None of these, however, answers as well as steam—the most efficient of all sterilizers.

Work of Feld and Burkheiser.

An interesting modern process is that of Dr. Walther Feld, whose death in his prime is a severe blow to science. A strenuous worker of great originality, Dr. Feld has enriched technology with many discoveries. The most important relates to the preparation of ammonium sulphate direct from crude coal gas. The problem of the utilization of the sulphur of the crude gas has thus been completely solved by a particularly neat and ingenious method. Using ammonium polythionate, there is ultimately obtained ammonium sulphate, sulphur, and sulphurous acid. The two latter are again utilized in the process, while the ammonium sulphate is obtained by evaporating the solution. The practical value of a process in which ammonium sulphate is obtained without the use of sulphuric acid is obvious. The researches of Feld in working out the details of this method also throw light upon many interesting scientific questions.

Another method of fixing nitrogen by utilizing the sulphur of coal is that of K. Burkheiser. In this process bog iron ore is used to absorb the sulphuretted hydrogen, and the sulphurous acid produced from it is used for the formation of a mixture of ammonium sulphate and sulphite. The process is working at Flemalle Grande, near Liège, in Belgium, and giving satisfactory results.

Preparation of Hydrogen and Coal.

The process recently patented by Dr. F. Bergius for the preparation of hydrogen, and his investigations of the preparation of coal from cellulose at high temperatures and pressures, are of deep interest. At high temperatures water acts as a fairly strong acid or base, provided it is kept liquid. In presence of a metal such as iron, hydrogen is evolved. The gas is obtained in a pure state, and the speed of the reaction is very high. The cost of production is about ¼d. per cubic metre at atmospheric pressure; and this would be reduced in large plants. It is considerably less than that of the cheapest method now known.

Water kept liquid by high pressures acts as an excellent thermostat in consequence of its high specific heat. This fact can be applied in the preparation of coal by the decomposition of cellulose. The product has all the chemical properties of natural coal, though physically it differs from it. If, however, the temperature and pressure during formation are greatly increased, a substance is obtained which closely resembles anthracite. The specific gravity increases with the duration of compression and the temperature employed.

Eye Preserving Glass.

I may perhaps be allowed to allude to such parts of my own work as may be of interest to industrial chemists. Such are the investigation of the spectrum of silicon in a very pure state, and also the preparation of eye-preserving glass for spectacles. The main object of this last research is to prepare a glass which would cut off those heat rays from molten glass which are injurious to the eyes of workmen, without obscuring too much light, or materially affecting the colours of objects seen through the glasses. The research was afterwards extended to the examination of the screening properties of different glasses for ultra-violet and luminous rays, and many specimens of glasses containing known quantities of pure metallic oxides and earths were prepared in my own laboratory. I succeeded in obtaining a glass which cut off 98 per cent. of the heat rays, while others, which I have called "Anti-Glare Glasses," cut off practically all the ultra-violet and a considerable proportion of the heat rays.

The Starving of Scientific Research.

In spite of the advances which I have just briefly brought to your notice, and notwithstanding the fact that the active investigation of scientific and industrial problems is going on at a rapid rate, the world is greatly in need of able researchers—perhaps more so now than at any previous time in its history. We may be certain that discoveries of vast importance are waiting their Newtons. Secrets of Nature are lying hidden ready to disclose themselves to the "immortal mind." But is not the attitude of the public towards investigators lacking in understanding and imagination, and do not the authorities treat scientific exploration in a niggardly spirit? Scientific men have to deplore the fact that there appears a lack of men gifted with the genius for research and for grappling with the riddles of the earth. Scientific research has been, and is being, starved. It is high time measures should be taken to remedy this state of affairs, which otherwise can only end disastrously for the nation. I do not wish to come before you as an alarmist, but rather as one who can diagnose the disease and suggest a remedy. I know you will be in hearty and enthusiastic agreement with me when I say that the allotment of public moneys to the furtherance of scientific work, the tangible recognition of the services of scientific men, the provision of opportunities for all kinds of investigations of scientific problems without reference to their immediate commercial value—these are the benefits we look for at the hands of the Government and of the nation.

And what are our responsibilities and our duties in regard to research? I think our chief care should be to see that we encourage and cultivate the right type of man for research work. We should make more definite efforts to select suitable men from among our students and to train them to the highest point of efficiency, after having made up our minds what are the special qualities we need. I think we can learn a great deal from the training of our army scouts. Our researchers are actually scouts, penetrating strange and unknown countries; and the keys to success are the same as for all scouts. The principal qualifications are confidence, keenness, intrepidity, inspiration. The knowledge that you are well equipped for your work, the belief that your training has been thorough, and that you have made the best possible use of it, should develop in you the self-reliance and the boldness indispensable in a scientific scout. Other valuable qualities, quickness of eye and mind, and the power of reasoning and expression, can undoubtedly be developed and perfected. And what can be promised as the reward of scientific work?—"Not

the reward, the work makes man sublime." Perhaps, after all, only the fight, the struggle, the search—but research, like virtue—

> "Desires no isles of the blest, no quiet seats of the just,
> To rest in a golden grove, or to bask in a summer sky;
> Give her the wages of going on, and not to die."

FUEL: GASEOUS, LIQUID, AND SOLID.

[A Discussion before the Birmingham Section of the Society of Chemical Industry.]

At their Meeting in May the Birmingham Section of the Society of Chemical Industry—Mr. H. T. PINNOCK in the chair—had a discussion on the subject of "Fuel: Gaseous, Liquid, and Solid;" and the July issue of the Society's "Transactions" contains a report of the proceedings for which we are indebted for the following particulars.

Professor JOHN W. COBB (Leeds), in opening the discussion, said that when such a fuel as coal was burned completely, the same amount of carbonic acid and water was always formed, and the same amount of heat generated; but the amount of heat utilized depended upon a number of considerations, and called for skill in the design and use of apparatus. Moreover, coal was not simply a potential source of so many heat units, but was a chemical substance capable of yielding other chemical substances of considerable commercial value on its way to carbon dioxide and water if the process were controlled. This was the reason for the existence of many fuel problems, and particularly modern fuel problems. If coal were burned in one stage, the smoke problem had to be faced. The existence of the smoke nuisance might be said briefly to be due to the particular fact that, though distillation and oxidation of coal could both go on at low temperatures, the distillation reached a high velocity at a comparatively low temperature, at which combustion was very slow. Another problem arose from the difficulty of using large quantities of fine dust coal. The dust below ground was a danger; and the most effective means of securing that it should be brought out was to make its economical use possible. Dust-firing for boilers and furnaces was fortunately making some headway.

A practical method of dealing with the smoke problem was to effect the combustion of coal in more than one stage—in one, the coal was gasified; in the other, the gas was burned. A blast of air used below a deep layer of glowing coal half-burned it to what was known as producer gas, which could be taken away and burned completely where desired. It contained the nitrogen of the air-blast, and so was called low-grade gas. If the coal were only heated, without contact with air, as in gas-retorts or coke-ovens, the gas contained very little nitrogen and was a high-grade gas. The advantage of producer gas was made obvious to certain industries by the introduction of the important principle (for fuel users) of regeneration. As soon as gaseous fuel was used, it became possible to design apparatus in such a way that some of the heat leaving the furnaces in the products of combustion was restored to the gas and air entering. Thus the open hearth steel process became a commercial possibility; a higher point of efficiency was attained, and the use of higher temperatures became feasible. The process of regeneration was necessary for high temperatures with producer gas, but ceased to be of the same importance with high-grade gas. The significance of this was best understood when one attempted to design a small-scale apparatus using the regenerative principle.

There was also the difficulty in applying the regenerative principle to small furnaces, that the expense of construction would be prohibitive, and the cost of renewal of complicated working parts too great. The possibilities of producer gas were much increased as soon as another disadvantage was removed. For delicate work there should be a proper control of the flow of gas and air; and the regenerators, ports, and passages should remain unfused, and be free from dust. A considerable step was made in the development of producer-gas engineering and furnaces when it became economical, on a large scale, to wash producer gas. This was effected successfully by the introduction of a plant the primary purpose of which was the recovery of ammonia.

Dr. Mond found that by the use of a large quantity of steam it was possible to get half of the nitrogen—a proportion since increased—as ammonia. Under his process about 2½ lbs. of steam were required for every pound of coal; and a considerable amount of the steam went through the producer undecomposed. So that to establish a high degree of thermal efficiency it became necessary to recover the latent heat of the large quantity of steam escaping through the producer. It was this which led to the system of washing towers, by which the gas was sent away washed and cooled. It could then be controlled and distributed in small pipes; and the most delicate ware could be exposed, if necessary, to the full action of the gas without danger from coal ash. A claim had recently been made that the same high ammonia results could be obtained with a smaller quantity of steam in the blast essentially by water-jacketing the top of the producer. But he thought that those who had had much to do with the ammonia recovery process would require a stricter and narrower definition of the claim made before accepting its probable validity.

Ammonia recovery introduced a new problem, since ammonia, when it was recovered in producer-gas, coal-gas, or coke-oven practice as ammonium sulphate, required that sulphuric acid should be brought to it, and this had to be bought or made. Interest, therefore, attached to any process which would do away with the necessity of providing sulphuric acid, especially in plants erected in somewhat inaccessible places abroad. The sulphur was in the coal. The ammonium sulphide was in the gas, and by the simple addition of oxygen one got ammonium sulphate. The addition of the oxygen was not a process as simple as it appeared, but several processes were on trial for doing it.

If no oxygen were used in gasifying coal, most of the carbon remained as coke; the rest going forward with other constituents as permanent gas, and as vapours. Until recently there were two established methods for working this sort of process. If town gas were required, it was made in retorts; if coke were the primary product desired, it was made in a coke-oven. Modern developments were tending to unify the science and practice of carbonization to this extent—that it would be more necessary in the future to carefully consider local conditions and markets, and decide what modification of plants, or what combination of them, was most effective. The old horizontal retort was being, to some extent, replaced by the vertical retort, in which gravitation was used to save labour; and continuous vertical retorts were another development. Processes were also being tried and worked in which the temperature and the conditions of carbonization were even further altered from the normal. One object was to make a coke which ignited easily and burned cheerfully. If a low temperature of carbonization was used, only a portion of the volatile matter was driven off from the coke—the part most likely to produce smoke. Such a substance was coalite. A disadvantage of low-temperature coke was that it was rather soft for carriage; and there was a difficulty in controlling the distribution of temperature in a retort working at low temperatures. It was apt to be irregular. In low-temperature carbonization it was not only the coke which was altered, but the gas was richer, and the tars and oils which came out and condensed were lighter. This was now a point of great importance, because of the large and increasing use of motor traffic and internal combustion engines generally. The demand had arisen for an increased supply of an oil or spirit which was easily and completely volatilized in a current of cool air, and could be used in a carburettor. One way of meeting the difficulty was to design a new carburettor working on a less volatile oil. Another way was to work out a process by which a mixture of oils of different densities, such as a crude petroleum, could be altered in chemical nature so as to contain a much higher proportion of volatile oils. Work in both these directions was being prosecuted vigorously. A third way which would increase the supply, although not to the extent sometimes stated, was to carbonize coal so as to yield a large supply of light oils. In the coalite process this was done by using a lower temperature; but processes were also being tried using higher and lower pressures. It was not, of course, correct to say that high benzene yields resulted from low temperatures; as a matter of fact, the volatile oils produced were more like petrol itself.

Whether coke or gas, or both, were burned, we should be freed from the smoke nuisance. But the gas industry was handicapped by a system of selling gas at a price too far above that of its manufacture and distribution. This policy had been defended as a definite means of indirect municipal taxation. It was a tax placed upon the home-manufactured article; and the competitor, raw coal, was out of reach of the imposer. In effect, it placed a premium upon the wasteful use of fuel and the pollution of the atmosphere.

Dr. W. B. DAVIDSON said he was strongly in agreement with Professor Cobb in suggesting that coal should be brought into disuse as much as possible, in favour of coke and gas. From eight years' personal experience, he could say that it was quite an easy matter to entirely displace coal in one's house. If he were on the City Council he would make it his business to bring forward a resolution that a bye-law be made prohibiting the use of coal unless it could be burned without smoke. Something drastic was necessary. The great objection to ordinary good gas coke was the difficulty of ignition because it contained only 1 or 2 per cent. of volatile matter. With a coke of 5 or 6 per cent., there was no difficulty in ignition. He was glad that Professor Cobb hit-out against municipalities who contributed to the rates from the gas profits. It was a great mistake not to reduce the price of gas to the lowest point. There was, he added, a tremendous wastage of fuel even in gas-works where huge quantities of coal were dealt with. In Birmingham the amount required in heating the retorts was 100,000 tons; and this amount could be cut down by the simple device of controlling the primary air, as by Brooke's air regulator. At one of the city gas-works the fuel consumed had been reduced from 25,000 tons to 16,000 tons per annum—a saving of 9000 tons, or an equivalent of £5000. If this were done in the whole of the Birmingham gas-works there would be a saving of 35,000 tons, or nearly £20,000 per annum.

Mr. COOPER stated that the production of metallurgical coke was about 11 million tons per annum, of which not more than 65 to 70 per cent. was produced in a scientific way. Taking a coal which had 30 per cent. of volatile matter, from this coal when carbonized in the modern coke-oven the yield of coke would be approximately 70 per cent. With the same amount of coal utilized in the old type of oven, there would probably not be more than 55 to 60 per cent. of coke. In addition, with the bye-product

oven one got 5500 cubic feet of surplus gas, about 30 lbs. of sulphate of ammonia, 10 gallons of tar, and 2½ gallons of benzol. In the case of the beehive oven one got nothing but the coke. It would be seen, therefore, that if all the coke were made in bye-product ovens there would be an enormous saving, amounting to some millions of pounds per annum. In Germany greater progress had been made in this respect than in this country, as was shown by the figures for the production of sulphate of ammonia. The rapid increase in production was due to the total adoption of bye-product coke-ovens in place of those of the beehive type. There were over 3000 beehive ovens in Yorkshire; over 4000 beehive ovens in Durham; and several others in other parts of the country. He thought it could be safely said that every class of coal which was coked at all could be dealt with in bye-product ovens. This was especially important also from the point of view of the production of gaseous fuel. Birmingham had taken the lead in another development—namely, the adoption of chamber ovens for gas production; and these had led to a great saving of fuel, on account of the fact that the ovens were heated by producer gas which could be made from inferior fuel, and the nitrogen could be recovered from these in the form of sulphate of ammonia. He was very sceptical as to the claims made in relation to the results of low-temperature carbonization. An interesting development of this system of carbonization which was to be worked on a Yorkshire colliery was a combination of the coalite process with gasification of the resulting coke in gas-producers. The Company working this scheme had realized the difficulty they might be faced with when it came to getting rid of the smokeless fuel; and they had, therefore, adopted the idea of gasifying this in producers and recovering the ammonia. The surplus gas was to be sold to an electric power company for the production of electricity. On a coke-oven plant the surplus gas was used for boiler-firing purposes and in some cases in gas-engines. Its value on the colliery for boiler-firing purposes as compared with coal, on the calorific value basis, was about 2d. per 1000 cubic feet.

Mr. H. T. Pinnock pointed out that it was the application of the regenerative and recuperative principle that brought prominence and position to producer gas. The principle was easily applied, and it was this circumstance which made it possible for producer gas to compete with higher power calorific gas for high temperature furnace use. As to the question of abstracting the sulphur from the producer gas, he agreed that such a course was most desirable both from the point of view of making sulphuric acid and to facilitate certain kinds of work in which sulphur was injurious. Finality had not been reached in regard to producer gas; and he thought it was likely to develop to this end on the lines of reduced steam consumption for making ammonia. He thought there would be difficulty, if it was a producer of large size—of from 10 feet to 11 feet diameter—to cool the interior of it sufficiently, merely by outside water jacketing. Another way in which producer plants might be expected to improve was in the more centralized extraction of tar. This was the bugbear of many plants which had to work in limited spaces. The tar had to be extracted at various places in cooling; and the colouring matter therefrom often found its way into the canals and drains, and caused conflict with the local authorities.

Mr. W. J. Rees was of opinion that progress must be along the lines of the recovery of the bye-products, particularly in gas-producer work. The serious question presented was the immense capital expenditure necessary in laying down recovery plants with works using large quantities of coal. It was also necessary to aim at the further removal of dust and of sulphur from producer gas; and if this could be economically achieved without resort to bye-product recovery, the advantage would be considerable to many industries, and to the glass industry in particular. With some fuels it was possible to keep some of the sulphur out of the producer gas by sprinkling the fuel with milk of lime; but this method was not really satisfactory in any way. As to the coal-dust problem, it was possible that much of the dust could be used by mixing with tar, and using in briquetted form. The London County Council insisted upon purchasing coal only on a calorific value basis. There were adopted four standards—calorific value, moisture, ash content, and price. Deductions were made *pro ratâ* if the fuel was below the standards agreed to in the contracts, with corresponding bonuses paid for fuel above the standards.

Mr. E. J. Guild stated that his firm (paper manufacturers in North Staffordshire) were reluctant to adopt mechanical stokers or patent furnaces. In order to avoid smoke they insisted on sending up an excess of air; and he asked if low-temperature coke would be of use to them. He also mentioned that his firm would not consider the use of oil or gas as fuels. His difficulty all along had been to induce them to use coal in a more economical way.

Dr. Davidson contended that not the least difficulty would be experienced in burning coke in a Lancashire boiler—and, of course, there was no smoke.

Mr. E. W. Smith said it was startling to hear that coal gas could be produced even at a colliery at 2d. per 1000 cubic feet. No doubt it could be made in the retort-house at this figure; but then all the charges for carriage, coal handling, and purifying the gas, and for distribution, must be added. Birmingham prices were extremely low, having regard to the rates in many other towns, so that manufacturers had the advantage. The aim must be to obtain the highest efficiencies in securing the greatest amount of heat from the original fuel, and also from the apparatus in which it was to be used. Until recent years it had not been possible to obtain economical results in heating processes; but now, as a result of improvements in the design of furnaces, the cost compared favourably with that of solid fuel furnaces and oil furnaces. He had no faith in the claims made for "surface combustion" at high temperature, nor with the results obtained. Although he had seen large apparatus working under the so-called new process, he had seen nothing, either in boilers or furnaces, practicable, or likely, efficiently, to last. The scientific explanations given with regard to surface combustion—in which there was nothing new either in the form of combustion or the type of furnace employed—were unnecessary and unsatisfactory. Interest would centre on an experiment shortly to be made, on the lines of low-temperature carbonization, by a large firm of continuous vertical retort makers. They were about to instal a plant in the Midlands for experiments on these lines mainly with a view to producing hard coke and large volatile oil yields. In the Birmingham gas-works fuel was being used in what appeared to be an ideal way. The volatile matter was first driven off from the coal; and the coke was then put into producers and gasified, and gas was made from this product with which the retorts were heated. This method gave the further advantage of enabling them to obtain bye products in sulphate. A drawback in the use of producer gas for industrial purposes lay in the fact that it contained a large amount of sulphur compounds. This was an almost insuperable stumbling-block in many processes. In the new Corporation plant experience showed that the tar was materially reduced by the centrifugal extractors before the sawdust scrubbers were reached. He did not see why it should not be possible to use coal dust when low in ash in coke-ovens compressed with water. The coke would be useful for small furnace work if the ash content was not too high. A coke of high porosity burned much more easily than ordinary gas coke, and ignited immediately from chips.

Mr. F. R. O'Shaughnessy stated that he was interested in two of the bye-products of the gas industry—viz., nitrogen and tar. The nitrogen in coal had an interesting biological significance, for its presence there instanced in a most striking manner the extraordinary stability of certain kinds of nitrogenous organic matter when subjected to destructive putrefaction. If one considered that the vegetable matter from which this nitrogen came underwent decay for an indefinitely long time when the temperature at the earth's surface was probably much higher than at present, the presence of so much residual nitrogen in the coal now was almost startling. In promoting destructive putrefaction of similar organic matter on the large scale which was present in sewage sludge, he was struck very much by the resistant character of the nitrogenous bodies, and next to mineral matters they were the most resistant normal constituents of the sludge. He would like to recommend this fact to the notice of enthusiasts who lamented the loss to agriculture entailed by our present methods of sewage disposal. The loss was not nearly so great as they imagined; for the bulk of the nitrogen was not available, and in fact the only way to make it available was to subject the dried sludge, like coal, to destructive distillation. By co-operation with the local gas officials experiments were to be made by him and them on making "producer" gas from the dried sludge with recovery of the nitrogen as ammonium sulphate. The other bye-product to which he referred—viz., tar—had a melancholy interest for him as a sewage expert. Certain portions of the tar were until recently not commercially recoverable, as they existed in the form of an emulsion; and not infrequently this aqueous residue found its way into the sewers and produced disastrous effects if allowed to enter the sludge digestion tanks. He was very pleased indeed to hear that this useless bye-product might be used for making briquettes, &c.; and he hoped the gas experts would be able to recover the whole of this tar and prevent it exerting its baneful influence on operations at sewage purification works.

Professor Cobb, in reply, said as regards tar extraction and ammonia recovery in producer-gas plant, centralization would simplify the cooling process; but he was doubtful as to air-condensers being applicable to large plants. The difficulty of cooling depended upon the fact that the thermal capacity was so enormously increased by the latent heat of the steam present. Calculations he had made on surface cooling gave discouraging results for a plant of any size. One difficulty of using coke-oven gas in regenerative furnaces was the considerable loss in actual heating power, when the gas passed through the regenerator, on account of the decomposition of hydrocarbons. Mixing with blast-furnace gas was reported to be successful. He agreed that the coke-oven process might deal satisfactorily with dust of certain qualities. Ash could not be determined accurately without very careful sampling, because so much was concentrated in the smaller coal, and particularly the dust. He agreed that the question of purchasing coal, on standardized lines, would assume greater importance in the future.

Referring to the list of successful candidates in the recent Examinations in Gas Engineering and Gas Supply published in last week's "Journal," we are asked to point out that it was Mr. J. D. Ashworth, junr., the son of the Engineer and General Manager of the Portsea Island Gaslight Company, who passed.

GLASGOW GAS EXHIBITION.

Available Space Filling Up.

A plan which came to hand a few days ago, in connection with the forthcoming Glasgow Corporation Gas Exhibition (incorporating Engineering and Machinery), shows that a very limited amount of space is still available for letting to exhibitors; the applications already received having been on a highly satisfactory scale. The exhibition (which will be held in the Exhibition Hall, New City Road) is to remain open from Sept. 23 till Oct. 17; and a feature of importance from the point of view of exhibitors is the fact that, as is pointed out by the Manager (Mr. James M. Freer), the annual conference of the British Commercial Gas Association will take place in Glasgow during the run of the exhibition.

To ensure uniformity of design and save expense to exhibitors, the Corporation will erect all the stands; and the price charged for floor space will include the cost of this. Another point is that gas will be supplied to exhibitors, up to a reasonable amount, free of charge. Arrangements are being made for showing, by the aid of the cinematograph, the latest developments in the use of gas; and there will be lectures on all subjects applicable to the aim and objects of the exhibition, as well as cookery demonstrations. The following is the classification of exhibits: (1) Domestic heating, stoves of all kinds, radiators, &c. (2) Gas heating, cooking, and laundry appliances. (3) Gas water-heaters, circulators, and geysers. (4) Gas lighting appliances. (5) Radiators for heating rooms and buildings. (6) Gas plants and engines for the generation of electricity and other purposes. (7) Gas-furnaces for case-hardening, annealing, tool-tempering, and metal melting, &c. (8) Fans and other appliances for ventilating and refreshing or cleansing the air. (9) All apparatus to prevent the emission of dust or grit from chimneys. (10) Shop window lighting, photography, &c.

The exhibition offices are at No. 38, Bath Street, Glasgow, and Nos. 30-32, Ludgate Hill, London.

SULPHATE OF AMMONIA COMMITTEE.

Seventeenth Annual Report.

The Executive Committee beg to submit to the subscribers the seventeenth annual report for the financial year ending June 30, 1914.

At the request of the Scottish subscribers a separate propaganda office under the direction of the Scottish members of the Executive Committee, with Mr. William Love, of the Broxburn Oil Company, as Convener, was established at 28, Royal Exchange Square, Glasgow, with Mr. J. D. Young, son of the late Mr. David Young, of the "North British Agriculturist," as manager. All propaganda work in Scotland is now dealt with by the Scottish Office, and the accounts indicate the nature and scope of the work done.

Agricultural Competitions.—Sixty-nine agricultural competitions were carried out during the 1913 season, the value of the prizes amounting to £441, as against £456 in the preceding year. The Committee have been continuously offering such prizes for the last sixteen years, and it has been found that while those Societies which have carried out competitions are almost always willing and anxious to do so again, great difficulty has been experienced in inducing Societies in other districts to organize competitions. It was therefore decided to discontinue the offer of prizes during the current season.

Literature.—The pamphlet entitled "Artificial Manures for the Farm, Small Holding, and Garden," which was first issued in the spring of 1913, has proved very popular—several editions having been printed, and, in all, some 125,000 copies circulated.

Reports on Field Experiments.—In September, the results of the manurial experiments for 1912 were issued in 28 different reports, which were widely distributed. In March this year the results of the 1913 field experiments were issued in pamphlet form; England and Wales being divided into eight districts, as follows:

North Eastern District .	Durham, Northumberland, Yorkshire.
North Western District .	Cheshire, Cumberland, Lancashire, Westmoreland.
East Anglian District. .	Cambridge, Essex, Hertford, Huntingdon, Norfolk, Suffolk.
East Midland District .	Bedford, Buckingham, Nottingham, Oxford, Rutland, Derby, Leicester, Lincoln, Northampton.
West Midland District .	Gloucester, Hereford, Monmouth, Salop, Stafford, Warwick, Worcester.
South Eastern District .	Berks, Hants, Isle of Wight, Kent, Surrey, Sussex.
South Western District .	Cornwall, Devon, Dorset, Somerset, Wilts.
Wales.	
Ireland.	

Field Experiments.—In 1913 and in the previous years in which plot work has been going on, the Committee appointed local supervisors of experiments, to each of whom was allotted the supervision of ten centres or thirty plots, though in some cases a larger number was apportioned. Thus in 1913 the Committee employed in England and Wales 67 men to supervise some 2350 plots. This system was not found to be entirely satisfactory. Some of the men were unable to carry their work through properly owing to other employment. In some cases it was found that they did not possess the requisite experience, and with such a large number of men it was difficult to exercise adequate supervision from the Head Office. After careful consideration, it was decided to discontinue this system and to engage whole-time men trained in agricultural colleges or having practical knowledge of farming, to whom certain districts have been allotted, and who are responsible for all experimental work in these districts under the control of the Committee's Manager, Mr. J. W. Tayleur.

The undermentioned were engaged for the districts named; but it was found in the cases of the North-Western and the East Midland districts that the areas were too large for one man to supervise properly. Two additional men were, therefore, subsequently engaged. The Committee have ten supervisors acting over all England and Wales, while the work in Ireland is still entrusted to Mr. W. M. O'Friel.

	District.
Mr. I. P. M'Ewan, B.Sc., 6, Arden Street, Darlington.	*North Eastern.*
Mr. A. O. Blackhurst, N.D.A., F.C.S., 14, Church Street, Adlington.	*North Western.*
Mr. W. Withers, C.D.A., Selside, near Kendal.	*Ditto.*
*Mr. R. Robson, M.Sc., F.Z.S., Newport, Essex.	*East Anglia.*
Mr. J. M. Druce, N.D.D., B.D.F.D., 1, Priory Road, Newark-on-Trent.	*East Midlands.*
Mr. J. G. Muirhead, C.D.A., Haslemere, Aspley Guise, Beds.	*Ditto.*
Mr. H. H. Chandler Botley Mill Farm, Henley-in-Arden.	*West Midlands.*
Mr. G. Lallemand, N.D.D., Cotlands, near Crawley.	*South Eastern.*
Mr. R. H. F. Walling, B.Sc., N.D.A., Cambridge House, Broadwindsor, Dorset.	*South Western.*
Mr. D. Thomas, Moylon Farm, Rhydlewis, Cardigan.	*Wales.*

[* Mr. Robson has resigned his position, having been offered a post under the Essex County Council, and Mr. T. D. Mosscrop, B.Sc. (Lond.), has been appointed in his stead.]

The services of these supervisors are at all times available to subscribers and their friends requiring information and advice on agricultural matters.

Motor Cycles.—To enable supervisors to travel rapidly about their districts, the Committee have supplied them with motor cycles and side-cars.

National Gas Exhibition.—At the National Gas Exhibition, Shepherd's Bush, the Committee had an attractive exhibit illustrative of their propaganda work. This consisted of a lawn, flowers, vegetable garden, farm crops, fruit trees, &c. The lateness of the date (October), and the atmosphere of the exhibition, were not favourable to growing plants; but, nevertheless, the exhibit was regarded as very successful.

International Meeting.—On Oct. 23 an "International Meeting of Sulphate of Ammonia Manufacturers" was held at the National Gas Exhibition and presided over by Sir Corbet Woodall, D.Sc., M.Inst.C.E. Admirable papers were read, giving information as to propaganda work in Europe and America, and representatives were present from the Syndicates of the United States of America, Belgium, France, and Germany. As a result of this meeting (a very full report of which was circulated), the Committee secured several important new subscribers.

New Subscribers.—During the year under notice 29 new subscribers have joined—viz.:

	In terms of Sulphate of Ammonia.
9 coal and iron firms	= 17,500 tons
20 gas undertakings	= 2,000 ,,
Total	19,500 tons

The total subscribers now number 446, representing a total of 303,924 tons—an increase over last year of 31,033 tons; being 19,500 tons from new subscribers as above, and nearly 12,000 tons increase in output from old subscribers. There still remains a very considerable non-contributing tonnage, and members are again urged to exercise their influence in inducing non-subscribers to join.

Foreign Propaganda.—Overseas propaganda in conjunction with the German Sulphate of Ammonia Syndicate is continuing successfully in the countries of Denmark, Holland, Italy, Sweden, and Switzerland, also in Egypt. Results of experiments undertaken last year in British India have not proved so satisfactory as was anticipated. The expert who visited India in the Committee's interests reports that the climatic conditions are generally unfavourable to sulphate of ammonia. The rapid nitrification induced by the intense heat and the heavy rainfalls militate against its successful use. Its employment is further handicapped by the abundant supply of oil cake which is employed as a fertilizer on a large scale and which unit for unit of nitrogen is cheaper and is said to give better results than sulphate of ammonia. The Committee are continuing their independent propaganda work in

Spain; but under new local management and somewhat different methods. More attention is now given to the commercial side—*i.e.*, getting in touch with, and interesting, the manure merchants, rather than devoting attention entirely to demonstration work with farmers.

The Committee regret to state that Mr. R. O. Paterson, of Cheltenham, who has retired into private life, and Mr. Alderman Miles, J.P., of the Bolton Corporation Gas Department, who finds increasing demands on his time, have resigned their seats on the Executive Committee. Both have been connected with the Committee for many years, and have done most valuable work on its behalf. Also, owing to continued ill-health during last year, Mr. Thomas Milne, who has acted as Deputy-Chairman and Chairman for the past ten years, has resigned. But the Executive are pleased to state that, after a very cordial invitation, they have secured for the position the services of Mr. D. Milne Watson, the General Manager of the Gas Light and Coke Company, and, as a consequence, the offices of the Sulphate of Ammonia Committee are being moved to No. 84-86, Horseferry Road, Westminster.

Subscribers and other sulphate of ammonia makers have from time to time had notice of the progress of the formation of the Sulphate of Ammonia Manufacturers' Association, the first meeting in connection with which took place in London last October. Rules for the working of this Association have been circulated to all producers of sulphate in the United Kingdom, and already makers representing a total of 200,000 tons or over have joined the movement. At a meeting held in London on May 26, 1914, a Board of Management was elected, the members of which are subscribers to this Committee and many are members of your Executive. A strongly supported request has been made that at the annual general meeting to be held on the 17th inst., a resolution be proposed that the new Association for selling sulphate shall be amalgamated with the existing Sulphate of Ammonia Committee and that the two sections shall work together under the name of the Sulphate of Ammonia Association, and that there be elected a Propaganda Committee to carry on propaganda work as formerly, and a Selling Committee to attend to sales. It is estimated that 9d. per ton will carry on the propaganda work and 6d. per ton the selling branch of the Association.

Messrs. Wood, Drew, and Co. offer themselves for re-election as Auditors to the Committee.

(Signed) D. Milne Watson, Chairman.

84-86, *Horseferry Road*,
Westminster, S.W., July 9, 1914.

A MODIFICATION OF THE JAEGER METHOD FOR ESTIMATING HYDROGEN AND METHANE.

In the "Chem. Weidblad" Herr Wibaut, the Chemist of the Amsterdam Eastern Gas-Works, recently wrote an article on this subject. The Jaeger method is a fractional combustion of hydrogen and methane; the gaseous mixture being passed over heated copper oxide, whereby at a temperature of 250° to 270° C., the hydrogen is consumed, while the methane is only consumed at red heat. In this way a quantitative separation is possible. As the oxygen necessary for the combustion is taken from the copper oxide, it is of no use to dilute the gas with air or oxygen. In the regular application of this method it was found that the hydrogen, and still more the methane, burned very slowly. Hempel in his book on analysis methods says that, for the estimation of hydrogen in town gas, he found it necessary to pass the gas fourteen times through a silica tube filled with copper oxide, and heated to a temperature of 250° to 280°C., before the loss in volume was constant. Dennis strongly recommends the use of the Jaeger method for the estimation of hydrogen, though the combustion is very slow. But for the estimation of the methane the slowness of combustion is such as almost to prevent the application of the method.

Now Wibaut has found that the combustion is accelerated by using a mixture of copper oxide and cerium dioxide. This latter oxide has, as is known, a catalytic accelerating influence on many oxidation processes. The copper oxide in fine granular form is mixed with cerium dioxide, obtained by heating cerium nitrate, and the mixture is placed in a small combustion tube. For the mixture there should be used just enough cerium dioxide to convert the black colour of the copper oxide into greyish white. A silica combustion tube is used, as tubes made from even the best sorts of glass do not stand the test very long. The author uses a very compact apparatus. The silica tube is put into a small heat generator and is connected on one side with a Hempel burette, and on the other side with a Hempel pipette filled with caustic potash. The author prefers a simple Hempel gas burette, without glass cocks, to a modified Bunte burette.

Before the beginning of the experiment the silica tube is filled with nitrogen, in order to avoid a correction for the loss in oxygen when the tube is filled with air. For the rest, the combustion is conducted in the usual manner. The addition of cerium dioxide has proved to have considerable influence on the velocity of combustion. The combustion of the hydrogen present in 100 c.c. of coal gas, solely with copper oxide at a temperature of 270° C., was completed by passing the gas four to six times through the tube and back—the first passages lasting two minutes, and afterwards only one. For the combustion of methane it is necessary to pass the gas very slowly six to ten times through the tube heated to redness. But when the copper oxide is mixed with cerium dioxide, the combustion of the hydrogen is completed in one or two passages, and that of methane after two or three times passing backwards and forwards.

Not only does the analysis take so much less time, but there is also another advantage. The expansion of the gas increases as the experiment proceeds, and, as in the last passages the loss in volume is very small, it is difficult to state when the process is at an end. The accelerated combustion due to the addition of cerium dioxide enables the end of the process to be located very accurately. In this manner a direct estimation of nitrogen in gas can easily and quickly be made, by simultaneously burning all the combustible components and noting the part remaining after the absorption of the products of combustion as nitrogen. After every experiment the copper oxide must be regenerated. The tube is connected on one side to a burette filled with oxygen, and on the other side to a pipette filled with water, and then the oxygen is passed backwards and forwards through the tube heated to redness, till no more oxygen is absorbed.

It might be questioned whether the addition of cerium dioxide would not cause a partial combustion of the methane at 270° C., owing to which the determination of the hydrogen would be too high and the figure for methane too low. But simultaneous analyses made with the same gas proved that this is not the case. In column I. of the following table, hydrogen and methane were estimated by combustion over copper oxide and cerium dioxide; in column II. the hydrogen was absorbed with palladium black, the methane being afterwards estimated by explosion.

	I.	II.
CO_2	2·0 per cent.	1·9 per cent.
C_nH_m	3·9 ,,	3·9 ,,
O_2	0·7 ,,	0·7 ,,
CO	15·2 ,,	15·3 ,,
H_2	49·5 ,,	49·9 ,,
CH_4	21·2 ,,	20·9 ,,
N_2	7·5 ,,	7·4 ,,

The differences are by no means greater than in common gas analysis with water in the burette.

Death of Mr. L. L. Merrifield.

The death occurred suddenly on the 21st ult., at his residence in Toronto, of Mr. L. L. Merrifield, the Chief Engineer of the Economical Gas Apparatus Construction Company, of which, in 1893, he was one of the organizers. In this undertaking he was associated with Mr. J. T. Westcott and Mr. W. H. Pearson—the last-named gentleman being the Chairman of the Company. Mr. Merrifield was Consulting Engineer to several important gas companies in Canada, including the Consumers' Gas Company of Toronto, by whom his services were highly appreciated. He was thoroughly absorbed in his profession, and was fully informed on all matters relating to gas practice and modern processes of manufacture, especially in connection with the production of water gas, the plant for which was the Company's speciality. He leaves a widow, but no family.

Gas Development in Central California.

According to the report for the past year which has lately been issued by the Pacific Gas and Electric Company, gas is being used in their territory in an increasing degree for industrial purposes. Among these may be mentioned the manufacture of cans, varnishes, barrels, &c., the operation of linotype and laundry machines, the roasting of coffee, the manufacture of jewellery, and the smelting of precious metals. One consumer of this class uses more than 20 million cubic feet of gas per annum. The Company manufacture their gas exclusively from crude oil under a process developed by their own staff. The chief characteristics of the process are the ease and economy with which the oil is handled as compared with coal, coke, &c.; the almost entire absence of residuals and waste materials; the flexible capacity of the works; and, consequent upon these, the comparative economy in labour employed at the works. As showing the growth of the Company's business, it may be mentioned that in the year 1906 there were in use 14 plants, of a total daily generator capacity of 16,440,000 cubic feet, 1147·26 miles of mains, and 3607 public lamps. Last year the number of plants was 17, the daily generator capacity 44,710,000 cubic feet, the length of mains 2374·18, and the number of public lamps 8924.

The Birmingham City Council have decided to extend the period of service of Mr. Thomas E. Clare, the City Treasurer, until Dec. 31, 1916. It was pointed out that Mr. Clare would attain the age of 65 in December next, and would then, in the ordinary course, retire on superannuation. It was, however, felt that it would be to the advantage of the public service that he should continue in office.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Reflections from "Field's Analysis."

SIR,—With reference to my article appearing in the issue of the "JOURNAL" for June 30, Mr. Irving, in his letter last week, introduced a point which I had not entirely lost sight of, although I agree it was not given the prominence it deserves.

I omitted to mention candle powers, which, as Mr. Irving points out, should be taken into consideration when makes are mentioned. I had this in mind when giving the table of oil used per 1000 cubic feet of water gas, so that the reader would have some idea as to what assistance had been received in this direction by the prodigal use of oil.

Mr. Irving's calculation (which is practically that of the gross multiple) introduces a fresh line of investigation, involving the relation between percentage of water gas, oil used, and spirit used for enrichment.

In this connection, I would like to point out that Bristol shows 106,164 gallons of spirit used—a still further complication in arriving at the actual merit of the gross multiple.

I am endeavouring to make up a table embodying the points above mentioned, and will try and send the same for next week's issue.

July 16, 1914. ENGINEER.

P.S.—I gather that Mr. Irving's letter, as published, contains obvious misprints, as for example: The first figure mentioned (13,422 candles) should be 13,472 cubic feet, and all the figures in the table he gives should be cubic feet instead of candles and decimals.

Gas Chemists' Summary, 1913.

SIR,—I have to thank Mr. Sheard for pointing out in his review of the above book ["JOURNAL," June 23] that the statement on page 68, "$\frac{1}{8}$-inch burner tube," should read, "$\frac{3}{8}$-inch burner tube."

I may perhaps be allowed to express at the same time my gratification that the volume as a whole has earned the commendation of so distinguished a critic.

South Suburban Gas Company, July 14, 1904. A. V. HENDRICKSON.

Sulphate of Ammonia Prices.

A CORRESPONDENT, writing on the 15th inst., says: "With reference to your correspondent in this week's 'JOURNAL' regarding the price realized for sulphate of ammonia, it may interest you to know that I have to-day sold a parcel of 30 tons at £10 1s. 3d. net and naked."

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The Sheffield Corporation Bill was read the first time and referred to the Examiners.

The City of London (Various Powers) Bill, Hayward's Heath Gas Bill, Gas Provisional Order (No. 2) Bill, and Gas Provisional Orders (No. 3) Bill were read a second time and committed.

The Riddings District Gas Bill and Tees Valley Water Bill were reported with amendments.

The Local Government Provisional Orders (Gas) Bill was re-committed to a Committee of the whole House, and reported without amendment.

The Commons' amendments to the Brentford Gas Bill, Chelmsford Gas Bill, Bedwas and Machen Urban District Council Bill, Market Rasen Water Bill, Hightown Gas and Electricity Bill, and Longwood and Slaithwaite Gas Bill were agreed to.

The City of London (Various Powers) Bill has been referred to a Select Committee consisting of Lord Haversham (Chairman), Viscount Selby, Lord Vivian, Lord Braye, and Lord Gorell; to meet to-day.

HOUSE OF COMMONS.

The Weston-super-Mare Urban District Council Bill was read the first time and referred to the Examiners.

The Edenbridge Gas Bill and Porthcawl Urban District Council Bill were read a second time and committed.

The Liverpool Gas Company Bill was reported with amendments.

The Hightown Gas and Electricity Bill, Longwood and Slaithwaite Gas Bill, Newport Corporation Bill, and Sheffield Corporation Bill were read the third time and passed.

Notice of motion was given for the rejection, on the second reading, of the Skegness Gas Bill, as amended.

The Lords' amendments to the Deal and Walmer Gas and Electricity Bill were agreed to.

Gas Undertakings Returns.

On the motion of Mr. Robertson, an order was made in the Lower House last Tuesday for the returns relating to statutory gas undertakings—for the year ending March 31, 1914, for local authorities, and the year ending Dec. 31, 1913, for companies.

Distillation of Oil from Coal.

Replying on Wednesday to questions by Mr. E. JONES, on various points, including the willingness of the Admiralty to promote inquiry, research, and experiment in reference to producing oil from coal,

Mr. CHURCHILL said that there were a number of considerations involved besides the question of research, and many other important interests were affected in addition to those of the Admiralty. The research side and the best methods of stimulating research would receive the fullest consideration. An Admiralty Departmental Committee had already been appointed to take up the consideration of various questions relating to oil supply. Certain definite proposals for inquiry in relation to the possibility of oil extraction from coal would be referred to the Committee for early consideration; and in the meantime he was unable to state in detail what steps would ultimately be taken. The Admiralty were not aware that any processes were being worked commercially in foreign countries for the distillation of oil from coal. No doubt some processes were being worked experimentally, and as far as he knew they were the same, or much the same, as those in England, which the Admiralty had under observation.

LIVERPOOL UNITED GASLIGHT BILL.

The Fazakerley Gas-Works Clause.

This Bill was last Thursday sent forward for third reading by the Unopposed Bills Committee of the House of Commons. The measure has already passed the House of Lords [see "JOURNAL," May 5 and 12, pp. 361 and 436].

Mr. WALTER SEDGWICK (Messrs. Rees and Freres, Parliamentary Agents) said there was one matter he would like to mention. A clause had been agreed between the Company and the Liverpool Corporation that the former shall, in the next session of Parliament, promote a Bill or apply to the Board of Trade for a Provisional Order for the purchase of the Corporation's existing gas-works in Fazakerley. The Corporation had asked the Company to take over these works, as it would be much more convenient to have the whole supply of gas in Liverpool in the hands of the Company. The exact wording of the clause is as follows:—

(1) The Company shall, in the next available session of Parliament, introduce and *bonâ fide* promote a Bill or apply to the Board of Trade for a Provisional Order under the Gas and Water Works Facilities Act, 1870, for the following purposes—that is to say: (*a*) extending the limits of supply of the Company so as to include the township of Fazakerley, in the City of Liverpool, and (*b*) authorizing the Company to purchase the gas undertaking of the Liverpool Corporation, which shall be deemed to include the mains, pipes, and other works in the said township belonging to, and used by, the Liverpool Corporation for the manufacture and supply of gas.

(2) The Liverpool Corporation shall not oppose such Bill or Provisional Order except in so far as may be necessary in order to secure the insertion therein of clauses or provisions to protect their interests with respect to such purchase, and not inconsistent with the provisions of this clause; and for that purpose the Liverpool Corporation shall be at liberty to petition the Board of Trade and either or both Houses of Parliament, and to appear upon any such petition by counsel, agents, and witnesses if they think fit.

(3) If any such Bill be passed into law, or any such Provisional Order be made by the Board of Trade and confirmed by Parliament, in either case containing the provisions for the purposes aforesaid, the said gas undertaking of the Liverpool Corporation shall, on such date as may be agreed between the Company and the Liverpool Corporation, and, in default of agreement, as may be determined by a single independent arbitrator to be appointed by the Board of Trade (hereinafter referred to as "the date of transfer"), be transferred to, and vested in, the Company, and as from the date of transfer all powers conferred upon the Liverpool Corporation by the Liverpool Corporation (Fazakerley) Gas Orders 1906 and 1911 (hereinafter referred to as the "Orders of 1906 and 1911") with reference to the manufacture and supply of gas by the Corporation shall cease, and the Orders of 1906 and 1911 shall be repealed.

(4) The Company shall pay to the Liverpool Corporation for the said gas undertaking so to be transferred to them a sum in cash equal to the net debt owing by the Corporation (including any debit balance at the bank on capital account) for the purposes of the Orders of 1906 and 1911—that is to say, the amount of any loans outstanding at the date of transfer.

(5) The Liverpool Corporation shall debit the net revenue account and credit the sinking fund accounts with a proportionate annual sinking fund charge in the event of the date of transfer being other than the 1st day of January, 1915.

(6) The Company shall also take over the movable stock in trade, implements, coals, and other stores held by the Liverpool Corporation in connection with the said gas undertaking, and the residual products of gas in hand at the date of transfer, at a valuation to be agreed upon between the Company and the Liverpool Corporation, or, failing agreement, to be determined by an independent engineer to be appointed by the Board of Trade, and the decision of such engineer as to what is comprised in such stock in trade and other stores shall be final and conclusive.

(7) All sums of money which, at the date of transfer, are in the hands of the Liverpool Corporation on account of any consumers of gas supplied by them shall be paid over to the Company as trustees for such consumers, but the Liverpool Corporation shall have the right to retain out of the deposit of any consumer any gas debt owing to them from such consumer.

(8) The Liverpool Corporation shall pay and discharge all outgoings and liabilities in connection with their gas undertaking up to the date of transfer, and shall collect on their own behalf and for their own benefit all arrears of gas-rents and other moneys which shall be due to them up to the end of the quarter next preceding the date of transfer, and the Company shall collect the gas-rents and other moneys which shall accrue during the quarter current at the date of transfer, and pay to the Liverpool Corpora-

tion the proportion thereof which shall have accrued in respect of the period of such current quarter up to the date of transfer.

(9) As from the date of transfer all contracts and agreements entered into by the Liverpool Corporation in relation to their gas undertaking shall be read and construed and may be enforced on behalf of or against the Company in all respects as if the name of the Company had been substituted therein for that of the Liverpool Corporation.

(10) The Liverpool Corporation shall maintain their said mains, pipes, and other works as existing at the passing of this Act in good order and condition as in the ordinary course of business until the date of transfer.

(11) The Liverpool Corporation shall not, after the passing of this Act, except with the consent of the Company, borrow any further moneys for the purposes of the Orders of 1906 and 1911, or expend further sums for capital purposes, or enter into any contract in connection with the manufacture or supply of gas or residual products by them which shall extend beyond the date of transfer, but such consent shall not be withheld in the event of such expenditure being necessary in the ordinary course of the proper conduct of the said gas undertaking.

(12) If it should be found necessary to promote a Bill for the purposes mentioned in sub-section (1) of this section, then the Liverpool Corporation shall pay to the Company one-half of the taxed costs, charges, and expenses incurred by the Company of and incidental to and preparing for, obtaining, and passing into law of, such Bill, and the said costs, charges, and expenses shall be taxed on the application of either the Company or the Liverpool Corporation by the Taxing Officer of the House of Lords or of the House of Commons.

(13) In the event of the Company promoting a Provisional Order for the purposes mentioned in sub section (1) of this section, it shall be lawful for the Board of Trade to insert in such Order any such provisions as may be necessary for giving effect to the provisions of this section and conferring upon the Company and the Liverpool Corporation all requisite, incidental, or ancillary powers in that behalf, and for the repealing or amending of the Orders of 1906 and 1911.

WADHURST AND DISTRICT GAS BILL.

When this Bill came before the Unopposed Bills Committee of the House of Lords last Tuesday,

Mr. E. C. COOPER (Messrs. R. W. Cooper and Sons, Parliamentary Agents) mentioned a verbal alteration in the purchase clause relating to the gas-works now carried on in Burwash by Mr. Taylor and Mr. Sixsmith. When the Bill was before Sir Harry Samuel's Committee of the House of Commons [see "JOURNAL," April 28, p. 272], the decision of the Committee was that the Burwash Gas-Works should be purchased for the sum of £1000. The clause as agreed, however, is now to the effect that the Company shall not exercise its powers in the portion of the parish of Burwash served by the existing gas-works until these gas-works have been purchased.

Another slight modification since the Bill left the House of Commons is that, instead of the tests by the gas examiner being carried out at any "reasonable hour," the tests shall take place "at any time between the hours prescribed by section 29 of the Gas-Works Clauses Act, 1871."

The Bill will not, however, be actually sent forward for third reading until the Lord Chairman has received particulars of an order made by the Court during the last few days with regard to the exact position under the final winding-up of the old Ticehurst Company.

LEGAL INTELLIGENCE.

DISPUTE OVER A DISCOUNT.

A Case at Bristol.

In the Bristol County Court last Tuesday, his Honour Judge GURNER heard a case in which the Ashton Gate Brewery Company sought to recover from the Bristol Gas Company a sum of £6 18s. 9d. paid by the plaintiffs under protest.

Mr. E. H. C. WETHERED, on behalf of the Brewery Company, explained that the action was brought to recover an amount of £6 18s. 9d. discount paid by the Brewery Company to the Gas Company under protest, and under a threat of the gas being cut off. Among other licensed houses owned by plaintiffs was the Royal Hotel at Avonmouth; and they took from the Gas Company a considerable quantity of gas. The Gas Company offered a discount to customers taking 500,000 cubic feet per annum, if consumed in one set of premises. The Royal Hotel at Avonmouth came under this provision; and the Brewery Company were entitled to, and as a fact had received until this occasion, the rebate of 6d. per 1000 cubic feet. The terms were printed on the demand note, and stated that the allowance would be made, provided the amount be received by the authorized collector, or at the chief offices of the Company, by 4 p.m. on April 30. Mr. Hartley, the Manager of the hotel, had always paid by cheque, deducting the discount. In April, however, he was confined to his bed by illness, and when the collector called about the middle of the month he was unable to sign the cheque. On the morning of April 30 he recollected that he had not paid the gas account, and, ill though he was, drew a cheque for the net amount, deducting £6 18s. 9d. He posted the letter himself at 10.45 in the morning. The Gas Company contended that the cheque was not received in time for the plaintiffs to be entitled to the rebate; the letter not reaching them until the next day. When the defendants threatened to cut off the gas if the balance was not forthcoming, the difference was paid under protest. The Gas Company had a private letter-box at the General Post Office, and they sent their own employee to collect the letters, which were not delivered by the post office. He argued that the defendants' private box at the post office was an extension of the Gas Company's premises, and that the letters put there were in fact delivered to them. The letter containing the cheque in question reached the post office at Bristol about 3.15, and was put in defendants' box before 3.30. The Gas Company retorted that this did not matter, as they did not collect the letter until next day.

Mr WEATHERLY, for the Gas Company (after evidence had been called), observed that there were no facts in dispute. It might seem a strange thing that two important companies should be quarrelling over a small sum; but he wished to make two observations. First, that the proportion which the sum bore to the bill was a considerable one (about 25 per cent. deduction); and, secondly, the condition had been well advertised, and if the Company once began giving way as to its fulfilment there would be no stopping. If a rich company asked to be excused lateness because the customer was ill, it would be all the more embarrassing if a poor customer made the request. Plaintiffs' contention really was that the post office was agent for the Company. If, however, a customer sent a letter by post, he must take the risk of its arrival in time.

His HONOUR, giving judgment, observed that he did not know what was behind the dispute, but it was like "making a mountain out of a mole-hill." He had come to the conclusion that the post office was not in any way the agent of the Gas Company, and there must be judgment for the defendants, with costs.

A MANTLE PATENT ACTION SETTLED.

The action of the *Plaissetty Mantle Syndicate v. Still and Sons* was mentioned to Mr. Justice SARGANT in the Chancery Division last Friday; the parties having arrived at a settlement.

Mr. C. TERRELL, representing the plaintiffs, said the action was brought in respect of the infringement of two patents—one No. 20,747, of 1901, and the other of 1902, both in respect of incandescent mantles. The defendants had agreed to submit to an injunction to pay to the plaintiffs a sum of £250 as damages, and 75 guineas costs. The defendants had also agreed to take a licence from the plaintiffs and pay royalties.

Mr. BRAY, who appeared for the defendants, assented; and his Lordship made an order in the terms agreed.

A RIVER LEA POLLUTION CASE.

The Tottenham District Light, Heat, and Power Company were summoned at the instance of the Lea Conservancy Board at Enfield Police Court, on Monday of last week—before Mr. H. TRENCHARD and other Magistrates—for discharging sewage and other offensive and injurious matter from the sewage drain pipe at their Edmonton works into the River Lea.

The Conservancy Board were represented by Mr. COOK, and the Gas Company by Mr. C. WHITELEY.

Mr. COOK outlined the Acts of Parliament, ranging from 1886 to 1900, under which the proceedings were taken, and emphasized the fact that, as the water was largely used for drinking purposes, the maintenance of its purity was of the utmost importance. As a result of samples being taken, crude sewage had been discovered in the outfall into Pymmes Brook, which was a tributary of the Lea.

Francis Robertson, water bailiff, stated that in April he went to the gas-works and took samples from the outfall running from the filter to Pymmes Brook.

Replying to Mr. WHITELEY, witness said he was not aware the water was the same as was taken from the brook 300 yards further up.

Mr. *Charles Young*, Analyst to the Board, spoke to testing the samples, and finding them to contain crude sewage.

Mr. *Charles Turner*, Engineer to the Board, submitted plans showing where the samples were taken.

In reply to Mr. WHITELEY, he said he was not aware of any intake from which the Company obtained water. Otherwise he would have charged them rent.

Mr. WHITELEY remarked that the defence was that the water before it was received by the Company was in exactly the same state as it was when it came from the outfall. From the time the water went in till the time it came out again, no sewage at all went into it. Moreover, the Company themselves had found that the water was so bad that they had to clean their apparatus periodically to get rid of the sewage introduced by means of the water. So bad was the water when it came in that one of the tanks had to be cleaned out every six months, and sometimes as much as 2 feet of solid sewage matter was got out.

Mr. *A. E. Broadberry*, Engineer and General Manager to the Company, said anything produced in the way of sewage on the premises went direct into the Council's sewer. The only water discharged into the brook was that pumped from Angel Road, which passed through the condensers and had no contact with any gas or its products. Every precaution was taken to prevent pollution. The water was really purer when it left the works than when it entered, because a lot of the sewage was left behind.

Harry Morley, foreman at the gas-works, produced three samples, one from the well, one from the tank, and the third from the outlet. These showed that the water was much clearer after passing through the works than before.

Mr. *Godfrey Warburton*, the Company's Chemist, gave evidence that the water at the intake was worse than at the outlet.

After deliberating in private, the Bench dismissed the case.

Mr. WHITELEY said if the Board had had regard to the Company's correspondence on the subject, the prosecution would have been quite unnecessary. He therefore asked for costs.

This was refused.

MISCELLANEOUS NEWS.

BRADFORD CORPORATION GAS DEPARTMENT.

Report by the Gas Engineer.

Mr. Charles Wood, the Engineer and Manager, has presented to the Bradford Corporation Gas Committee his report and statistics dealing with the working of the undertaking during the year ended March 31 last.

Mr. Wood says the simple statement that the year's trading shows a net loss of £865, as against a net profit of £19,745 in the previous year, may appear somewhat disappointing, until all the circumstances are taken into consideration. Last year's profits were a record, and were largely due to having purchased a large portion of the year's coal before prices had materially advanced. For some years it has been the policy of the Gas Committee to sell gas at very little above cost price; and the average net profits made during the past ten years have been £5693 per annum. Owing to the extortionate prices demanded for coal, the fall in the values of residuals, and the increasing cost of labour and materials, the past year has been an exceedingly trying one for all gas undertakings. Few indeed have been able to maintain their profits, while many have had to draw extensively upon their reserve funds to pay dividends and interest. The Committee have every reason to be satisfied with the working results obtained during the year. On almost every point an improvement is shown; and it is only in matters quite beyond its control that the department has financially suffered.

The cost of coal used, including handling, was 13s. 0·85d. per ton, which is the highest price Bradford has had to pay for thirteen years. This figure is 1s. 6·3d. per ton more than last year's, and is equivalent to an advance of £15,475 for the quantity used. By the improved working of the vertical retorts at the Thornton Road works, there has been extracted more gas per ton of coal, so that the actual additional cost of coal has been £10,779. The prices of nearly all materials used have gone up, and wages in the works were advanced by over £1800. Consequently the item of repairs and maintenance shows an increase of £5183. The cost of maintenance of mains, meters, and stoves is on the increase; so are rates and establishment charges. These items together account for another £2000 additional expenditure.

On the revenue side, the gas receipts are £1806 less, nearly all of which is due to the reduced charge for gas used by engines. He is pleased to say that the result of this reduction has so far been very gratifying, as the quantity of gas used by engines during the half year ended Dec. 31 last shows an increase of 11·54 per cent. upon the corresponding period of 1912. The drop in the value of sulphate of ammonia has, next to the cost of coal, been the worst incident of the year; the revenue for ammoniacal liquor being £4808 down. The cost of the public street lighting is becoming an increasing burden. The lamplighters' wages were advanced to the extent of £1350, while repairers' wages and materials cost £1207 more, after allowing for the additional lamps erected. Altogether public lighting cost £37,027, being an advance of £3306, or £9527 more than the Finance Committee have paid.

In view of all these difficulties, Mr. Wood thinks they should be thankful that the results are as good as they are. If it were not for the vertical retorts at Thornton Road, they would have been at least £10,000 worse off, and would probably have been obliged to follow the example of other towns and raise the selling price of gas.

All new services and all repairs and renewals of plant have again been charged directly to revenue. The charges for interest and sinking fund upon the goodwill alone of the various added gas undertakings amounted to upwards of £18,000 during the year. The benefit to the consumers in these districts owing to the reduction in price by the Corporation was £15,236 for the year.

The total quantity of gas produced during the year was 2,261,353,000 cubic feet, being an increase of 58,208,000 cubic feet, or 2·64 per cent., compared with the previous year. The gas sold—including 174,904,000 cubic feet used in the public lamps—amounted to 2,100,495,000 cubic feet, being an increase of 1·72 per cent. The following table gives the quantities of gas sold in the different districts during the year ended Dec. 31 last, and the preceding year (1912). For purposes of comparison, the figures for 1899 are also shown; this period being prior to the taking over of the North Bierley, Clayton, Eccleshill, Idle, and Heaton districts.

Districts Within the City.	Years Ended 31st December,			Increase During One Year. (Per Cent.)	Increase During 14 Years. (Per Cent.)
	1899.	1912.	1913.		
	Thousands.	Thousands.	Thousands.		
Bradford (old district and including Ripleyville)	1,531,517	1,546,368	1,593,814	3·06	4·06
North Bierley	56,371	98,882	104,115	5·29	84·69
Clayton	33,129	51,066	52,455	2·72	58·33
Eccleshill	22,884	36,137	36,778	1·77	60·71
Idle	30,860	54,041	55,615	2·91	80·21
Heaton and Frizinghall, about	22,500	31,093	32,667	5·06	45·18
Districts without the City.					
North Bierley	14,654	21,450	23,009	7·26	57·01
Clayton	33,845	34,014	35,649	4·80	5·33

The fact that this year there is an increase in every district is, Mr. Wood remarks, very gratifying.

During the year ended March 31 last, 202,956 tons of coal and cannel were carbonized. Cannel to the extent of 3·23 per cent. has been used, as against 6·06 per cent. last year. The average cost of the coal and cannel used—including cartage and handling—was 13s. 0·85d. per ton; the figure for last year being 11s. 6·55d. There were 295 lbs. of coal carbonized per ordinary retort charged, or 2 lbs. less than last year. As the vertical retorts at Thornton Road are charged continuously, they are excluded. The average quantity of gas made per ton of coal was 11,142 cubic feet, being 705 feet more than last year. This increase is all due to the vertical retorts.

Dealing with the actual revenue account for the year, the total salaries for manufacture, distribution, and management amounted to £5916. Carbonizing wages absorbed £24,869, a decrease of £3524; fewer stokers now being required. Coal cost £132,647, or £10,779 more; and the expenditure on purification was £3510, a decrease of £758. The sum of £35,529 was spent on repairs and maintenance of works, being £5183 more. Both these last two items have been affected by the extra cost of materials and advanced wages. The repairs to mains and services—including the cost of new services—amounted to £7190, an increase of £418. There was spent £967 on repairs and maintenance of meters, or £224 less. Meter inspection cost £4178, or an increase of £112. The Finance Committee's charges for administration and collection of accounts were £1700, being the same as for several years past. Miscellaneous expenses amounted to £1344, showing an increase of £199. Stationery cost £730, or £95 more; and bad debts, which amounted to £638, show a decrease of £185—the lowest figure for many years. The amount paid for rents—principally ground rents—was £643. There was paid £14,987 for rates, or £778 more. The stove department cost £5252, and the revenue from it was £4723, leaving the net cost at £529.

The following are the main items of income: £196,151 was received for gas, being a decrease of £1806, due to the reduction in price for engines. Meter-rents produced £2803, or £107 more. Coke yielded £46,080, or £1883 less. Tar brought in £21,501, being a decrease of £64; and ammoniacal liquor produced £18,264, a decrease of £4808. From the sale of spent oxide to the chemical-works there was obtained £2320, a decrease of £74. The cost of coal, less residuals (excluding profit on the chemical-works), was £132,647, being £13,149 worse than last year. Purification, less revenue from spent oxide, cost £1190, or £684 less. Rents received amounted to £1171, or £46 more. The gross profit on the chemical-works—including the profit on the sale of ammoniacal liquor—was £4450, as against £4067.

The gross or trading profit for the year amounted to £57,361, being £21,593 less than for the previous year. Interest on loans, &c., amounted to £27,309, which is a decrease of £681. Income-tax was £204 less, while the sinking fund contribution of £27,681 shows a decrease of £97. The net loss is £865.

During the year the sum of £6187 was spent on capital account. This amount is made up of £3853 on new mains, £2194 on the vertical retort installation at Thornton Road, and £140 at the chemical-works. The total expenditure on capital account to the end of the year was £1,212,407, of which £516,176 has already been repaid.

There was received the usual contribution from the Finance Committee of £27,500 towards the cost of street lighting. As already pointed out, it has cost £9527 in addition. The amount paid to the department for the gas used in the lamps works out at 10·67d. per 1000 cubic feet. No response has yet been made to the Gas Committee's request for an increased contribution.

The average cost of the gas per 1000 cubic feet in the holders has gone up to 11·184d. The average illuminating power of the gas supplied during the year has been maintained well above the standard, and the purity has been further improved.

The total outstanding debt of the undertaking on March 31 last was £680,309. The gross or trading profit made during the year was £57,361, which is equal to 8·43 per cent. upon the present actual debt. The prospects for the present year are, Mr. Wood is sorry to say, not very bright. It will be possible to buy coal a little cheaper; but the markets for residuals are not promising at all well.

The following are some of the items from the working statement for the past year; the figures for 1913 being given for comparison.

	1913.		1914.
Coal and cannel carbonized, tons	211,071	..	202,956
Cannel carbonized, per cent.	6·06	..	3·23
Gas made, cubic feet, thousands	2,203,145	..	2,261,353
,, ,, per ton of coal	10,437	..	11,142
Gas accounted for, thousands	2,064,796	..	2,100,495
,, ,, ,, per ton of coal	9,782	..	10,376
,, ,, per cent. on make	93·72	..	92·89
Gas unaccounted for, per cent. on make	6·28	..	7·11

The analysis of the accounts shows that the net cost of gas was £138,790, or 15 858d. per 1000 cubic feet sold, compared with £119,081, or 13·841d. per 1000 feet sold, in the previous year.

VERTICAL RETORTS AT DUNFERMLINE.

A report on their vertical retort installation has been submitted by Mr. Alexander Waddell, Borough Gas Engineer and Manager, to the members of the Gas Committee of the Dunfermline Town Council.

In December, 1911, the members, Mr. Waddell states, agreed that a bench of four vertical retorts should be erected in their works, to the designs submitted by the department. This class of setting was then in its infancy; yet many experienced and progressive minds in the gas engineering world favoured the idea that this form of carbonizing was capable of giving such improved results that it deserved serious consideration from the industry. It was apparent that the immensity of the work involved in designing these retorts was such that few would venture to undertake it; and very few designs had appeared. It was to be borne in mind that, while the few who had preceded them in these settings admitted that the amount of work in the designing was great, they also admitted that alterations of work erected to these designs were far greater and cost many thousands of pounds to make the plant a practical working success. Hence the convincing evidence of their courage and enterprise in agreeing to have a full-sized trial setting of

this plant designed and erected, as it largely depended on how the setting designed turned out in practice.

With at least some knowledge of the difficulties and responsibilities of the work involved, this long patience-trying period to them had been spent in a constant effort to secure their best interests by making the plant at once simple (therefore reasonable in cost of erection and easy to work), yet reliable, and at the same time yield the maximum values in gas, tar, ammonia, and coke from the coal.

To do this, the greatest amount of experience in every one of the known technical and other points was thoroughly considered; and where departures were made from the beaten track, evidence was obtained from any and every likely place, and particularly from the allied industries, where they received valuable assistance. In the course of this work, they had frequently been in tight places, and required months to solve some points. When every available known means failed them, such difficulties were only overcome by endless searching for a rock-bed of the solution, and a practical and satisfactory way out of the difficulty evolved after long and continued thinking. In four of these cases, they believed that valuable new and improved portions of vertical retorts had resulted.

Evidence of the efficiency of the vertical as compared with horizontal retorts is given in the table of results below:

Average Test of Lumphinnans Trebles with Vertical Retorts.

Gas made per ton	12,334 cubic feet.
Coal per retort per 24 hours	3 tons 15 cwt. 1 qr. 21 lbs.
Gas made per retort per 24 hours	46,525 cubic feet.
Calorific value of gas	510 B.Th.U.
Generator fuel per 100 lbs. coal	13·73 lbs.
Yield of tar per ton	14·47 gallons.
Sulphate of ammonia per ton	26·77 lbs.

Average Test of Horizontal Retorts.

Gas made per ton	9000 cubic feet.
Coal per retort per 24 hours	15 cwt.
Gas made per retort per 24 hours	7000 cubic feet.
Calorific value of gas	540 B.Th.U.
Generator fuel per 100 lbs. coal	15·5 lbs.
Yield of tar per ton	11 gallons,
Sulphate of ammonia per ton	17 lbs.

The cost of the trial setting of four vertical retorts would be just about equal to £400 per retort. The saving effected, after allowing for interest and sinking fund, would mean about £600 a year on the setting; and when other similar settings were erected, the cost of the erection would not exceed the cost of the present ones.

Mr. Waddell added that the retorts, without a single alteration since they were erected, had been working successfully since February last. Besides the saving in money, the conditions of the workmen attending them had been much improved, in respect that the smoke and dust had been greatly reduced, and the men were not now exposed to the excessive heat which they had to bear while attending horizontal retorts. In short, the gas, tar, and ammonia per ton of coal carbonized had been considerably increased, and the quality of coke made was higher; while the generator fuel and labour had been correspondingly reduced, and the working conditions improved.

It is significant to add that the Gas Committee have recommended to the Council that Mr. Waddell's salary be increased by £100.

WOODALL-DUCKHAM VERTICALS FOR WORKINGTON.

Particulars were given last week [p. 119] of an application by the Workington Corporation for sanction to borrow £25,000 for proposed extensions of the gas-works. Of this sum, about £17,000 is required for a retort-house, carbonizing plant, and machinery, according to a tender of the Woodall-Duckham Vertical Retort Company.

At the Local Government Board inquiry much of the evidence, of course, was in regard to this part of the application, in connection with which Mr. Horace Chamberlain (the Gas Engineer) furnished the following remarks: "The existing carbonizing plant consists of six beds of eight through retorts capable of carbonizing, under normal conditions, 50 tons of coal per diem, producing 600,000 cubic feet of gas. The greatest quantity of gas sent out to date is 559,000 cubic feet; and as the sale for the current year to date has increased by 10 per cent., this figure will amount to 618,000 cubic feet per diem without any allowance for the extended area. It can safely be assumed that during the winter of 1915-16 our maximum daily sale will reach 680,000 cubic feet. Moreover, dispensing with a retort for scurfing or repairs during the period of heaviest demand would be very serious. Consequently, our existing plant will not leave any margin during the coming winter season, and will be totally inadequate to cope with the estimated demand during the 1915-16 winter season. Apart from this, the condition of the benches is such that a certain amount of risk will be involved in relying on them even during the coming winter, as the foundations are in such a condition as to cause anxiety. . . . With regard to the adoption of continuous vertical retorts, the increased yield of gas and quantity of residuals saleable, together with the decreased cost of labour, amply justify the expenditure of the necessary capital. Our present labour cost for carbonizing amounts to 3s. 1d. per ton. The proposed vertical plant will be worked at its minimum output for 11d. per ton, and at its maximum output for 9d. per ton. With our present plant, the cost for labour per ton increases as the quantity of coal carbonized increases, whereas with verticals the reverse is the case. The low quantity of naphthalene found in gas from continuous vertical retorts saves considerable annoyance and expense. Finally, carbonizing by means of continuous vertical retorts is the only system which ensures the men working in a healthy and smokeless atmosphere, and where they are not exposed to any degree of heat. An additional advantage lies in the fact that only by the adoption of this system will it be possible to double the capacity of the proposed plant without purchasing additional land."

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GAS SUPPLY IN GREATER NEW YORK.

Particulars from the Reports to the Bureau of Statistics.

Some interesting figures concerning the operations of the nineteen Gas Companies in Greater New York during the year ended Dec. 31, 1913, are contained in the reports submitted to the Bureau of Statistics of the Public Service Commission. They appear in "The Gas Age" for the 1st inst., and from them the following have been selected.

In the twelve months covered by the reports there were sold 42,731,865,000 cubic feet of gas, or rather more than 8964 cubic feet per inhabitant, according to the census of 1910. The make in the same period was 45,672,715,000 cubic feet. To produce this quantity of gas 1,563,622 tons of coal and coke and 161,688,546 gallons of oil were required. Of the coal and coke used, the boiler fuel amounted to 153 612 tons, the retort fuel to 82,506 tons, the generator fuel to 609,904 tons, and 717,600 tons were carbonized. The Consolidated Gas Company made 6,915,624,000 cubic feet, but bought 10,356,005,000 cubic feet from the Astoria Light, Heat, and Power Company, selling to their consumers 16,553,736,000 cubic feet. The Brooklyn Union Gas Company, the leading Brooklyn company, manufactured 14,316,303,000 cubic feet, and sold 11,270,978,000 cubic feet.

There are within Greater New York 136 gasholders, of which the Consolidated Gas Company have 44, the Brooklyn Company 27, and the New Amsterdam Company 13; the remaining companies owning the rest. These holders have a total capacity of 182,446,000 cubic feet; those of the Consolidated Company storing 53,770,000 cubic feet. The companies lost 2,674,307,000 cubic feet of gas, or nearly 6 per cent. of the entire quantity manufactured. The loss by the Brooklyn Union Company was 811,977,000 cubic feet—the highest of all the companies; while the Consolidated Company's figure was 481,097,000 cubic feet.

In the sale of residuals the companies realized a very considerable amount. Three of them made and sold coke, the Astoria Company selling 173,059 tons, for which they received $539,433.57—an average of $3.11 per ton. For 39,860 tons sold by the Consolidated Company they received $143,645.25—an average of $3.60 per ton; while the Central Company sold 28,483 tons, for which they received $124,839, or an average of $4.38 per ton. The three Companies made 499,678 tons of coke, used 238,488 tons, and sold 241,402 tons. In addition to the sale of coke, three companies sold 8,935,513 gallons of coal-gas tar for $252,524—an average of nearly 3 c. per gallon; and 4,431,813 gallons of water-gas tar for $122,785, or an average of nearly 3 c. per gallon. The Northern Company, which is controlled by the Consolidated Company, and the Newtown, Flatbush, Jamaica, Richmond Hill and Queen's County, and Woodhaven Companies, all controlled by the Brooklyn Union Company, purchased their entire supply of gas, having no manufacturing plants.

The following table furnishes particulars regarding manufacture and distribution:

Name of Company.	Gas Made. (Thousands.)	Gas Sold. (Thousands.)	Unaccounted for. (Thousands.)	Miles of Mains.	No. of Service Pipes.	No. of Meters.
Consolidated	6,915,624	16,553,736	481,097	841·139	71,458	486,579
New York Mutual	2,427,589	1,816,219	119,280	169·85	19,284	45,842
Astoria	10,372,054	150	—	3687 feet	3	3
Northern Union	—	1,402,446	163,605	173·02	12,292	51,539
Central Union	3,144,809	2,521,795	137,528	158·40	15,165	95,910
New Amsterdam	3,960,476	3,102,664	266,836	331·34	32,253	103,325
Standard	2,119,456	2,033,200	153,776	202·92	17,078	57,226
Bronx (Gas and Electric)	190,904	165,448	24,781	55·23	3,648	6,622
Newtown	—	742,040	64,789	171·96	16,200	35,330
Flatbush	—	721,535	62,813	107·36	11,170	22,105
Brooklyn Borough	370,149	318,506	48,732	100·97	9,728	9,063
Kings County	892,453	730,295	159,082	177·919	15,555	24,532
Brooklyn Union	14,316,308	11,270,978	811,977	966·78	135,426	381,199
Jamaica	—	162,952	14,209	74·84	6,411	5,839
Richmond Hill and Queens County	—	127,832	11,177	30·99	3,291	3,918
Woodhaven	—	239,542	20,896	80·50	7,568	9,679
New York and Richmond	391,263	347,829	39,635	110·10	10,773	14,381
New York and Queens	271,551	220,679	49,245	96·25	6,035	7,944
Queen's Borough (Gas and Electric)	300,084	254,019	44,849	144·66	8,266	5,196
Totals	45,672,715	42,731,865	2,674,307	3994·228	401,604	1,366,232

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INCREASED GAS SALES AT OSSETT.

The report of the Gas Manager (Mr. A. E. Mottram) on the working of the gas undertaking in the past financial year was submitted to the Ossett Town Council last week. It stated that the quantity of gas sold was 135¾ million cubic feet, which was an increase of over 4 million feet on the previous year. Bad trade had been responsible for a decreased consumption in the large mills. The gross profit was £6743, and interest and sinking fund charges absorbed £6231, leaving a net profit of £512, which was sufficient to complete the reserve fund of £5000 and leave a small balance. The Mayor (Mr. H. Robinson) said that though the results were somewhat disappointing, they were better than those of most of the undertakings in the district. The cause of the general setback was the increased cost of everything they had to buy and the decreased price of everything they had to sell except gas. They had used 13,083 tons of coal, or 500 tons more than last year, and the increase in the cost was £1090. It was a strange feature of the year that the value of residuals had not increased in sympathy with the higher price of coal. Yet despite these facts the gross profit was only £329 less; and they had avoided doing what many other authorities had done—increasing the price charged for gas. The reserve fund was now at its maximum of £5000; and the interest accruing from it would be appropriated in relief of the rates. Speaking of the future, he expressed the view that coal would be purchased at a substantial reduction, and though the capital expenditure was being increased largely, by erecting an installation of vertical retorts, it was expected that a more than counterbalancing saving would result.

GAS CONSUMPTION AT MANSFIELD.

Concurrently with Mansfield's growth, due largely to the exploitation of the mineral resources of the district, a great increase is reported in gas consumption. The exhibition of cooking and other apparatus which has recently been held in the Town Hall has done much to afford desirable practical details; and at an official dinner which has been given in connection with the display—when the chair was occupied by Mr. H. M. Thornton, of the Richmond Gas Stove and Meter Company—the information was forthcoming from Mr. W. J. Rendell Baker (the Corporation Gas Engineer) that there had been a steadily extending consumption, the increase during the previous seven days being 579,000 cubic feet. Referring to the comparisons which had been drawn between gas and electricity, Mr. Baker alluded to the fact that gas was introduced into Pall Mall 102 years since, and it was still there, where he believed it would remain. Gas engineers were not, he said, afraid of gas being shut out. At the same time, he agreed that there was plenty of room in Mansfield for both the gas and electricity undertakings.

Mr. T. Smith (the Chairman of the Gas Committee), comparing the charges made in the town for gas to-day with those in operation in 1823, when the works were established, stated that 10s. 6d. per 1000 feet was charged in the earlier period, as against 2s. 6d. at the present time. Mansfield was to-day making 201 million cubic feet of gas per year, and they anticipated very greatly increasing the output in the near future—in view of the large number of stoves which had been hired-out as a result of the exhibition. The Committee were determined to give the town the best light they could, and moreover they intended to have the back streets as well illuminated as the main thoroughfares.

Mr. Thornton, in proposing the principal toast, emphasized his conviction that the Corporation were doing the right thing in educating the working classes in the use of the gas-cooker. A few years ago the City of Manchester had scarcely a gas-stove in its boundaries; but to-day it had 50,000 in use.

Mr. J. H. Collins (the Chairman of the Electricity Committee) mentioned that when he was appointed there was a loss on the undertaking of £800; but this year they would make a bigger profit than the Gas Committee if they excluded the sale of residuals from the gas figures. Their total profit for the past twelve months would be £1600.

The Gas Committee, it may be mentioned, propose to hand over this year £1500 in relief of the rates, the Electricity Committee £800, and the Water Committee £2300.

LEIGH (LANCS.) GAS AND WATER SUPPLY.

The Gas and Water Engineer of the Leigh (Lancs.) Corporation, Mr. James Gibson, has presented his reports on the working of the undertakings under his control in the year ended March 31.

The gross profit for the year on the Gas Department was £11,959; being 6·79 per cent. on the capital invested in the undertaking. After deducting sinking fund and interest charges, £9907, equal to 1s. 3·03d. per 1000 cubic feet of gas sold, there was left a net profit of £2052. Out of this certain special charges were paid, bringing down the profit to £1801, which was carried to the net revenue account. The quantity of coal carbonized was 15,093 tons, and 168,768,000 cubic feet of gas were sent out, of which 160,696,400 cubic feet were accounted for. The gas sold for general consumption (including the public lighting) was 158,163,000 cubic feet. Through ordinary prepayment meters, 56,001,200 cubic feet of gas were sold; and through similar meters with corporation fittings, 9,427,800 cubic feet. The coke saleable per ton of coal carbonized was 10·73 cwt. The make of sulphate was 25·23 lbs. per ton.

During the year 201 new services were laid; while the total number of consumers increased by 252, or 2·73 per cent. At the end of the year there were 26 gas-engines connected with the mains, and during the twelve months 1,869,700 cubic feet of gas were sold for power purposes, as compared with 1,696,500 feet in the previous year. The

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See Competitors' Statement, "JOURNAL OF GAS LIGHTING," July 14, 1914, p. 120.

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make of gas per ton of coal carbonized was 11,660 cubic feet (average power 17·64 candles), and the sale 10,479 feet. The lessened net profit is more than accounted for by the increase in the cost of coal (£943) and the reduction in the price of gas to slot consumers (£312). Owing to the increased consumption of gas, it has been necessary to extend the carbonizing plant; and the Committee have made a contract for an installation of vertical retorts with the Vertical Retort Syndicate. This plant Mr. Gibson hopes will be completed in time to cope with next winter's consumption.

The capital invested in the works at the close of the financial year (excluding the cost of the scrubber-washer, exhauster, and carburetted water-gas plant) was £176,085; being at the rate of £11 10s. 9 54d. per ton of coal carbonized, 20s. 10d. per 1000 cubic feet of gas made, and 22s. 3·19d. per 1000 cubic feet of gas sold.

The revenue account of the water undertaking shows a loss of £573, as compared with a loss of £1199 for the previous year. The decreased deficit is owing to the large increase in the revenue obtained for water sold per meter for trade purposes. The consumption per head per day for domestic purposes was 12·96 gallons, and for trade purposes 4·06 gallons—a total of 17·02 gallons per head.

CITY ELECTRIC LIGHTING COMPANIES.

The Power to Purchase.

It was stated in "The Times" last Tuesday that, doubts having arisen as to the powers of the Corporation to purchase so much of the undertaking of the City of London and Charing Cross Electric Light Companies as relates to the City, Counsel have been consulted. The late Mr. Danckwerts, K.C., and the Law Officers of the Corporation were of opinion that the power to purchase could be exercised during the six months following Aug. 18 next, or, if not then exercised, within the six months following Aug. 18, 1924. On the other hand, Sir Robert Finlay, K.C., Mr. Cave, K.C., and Mr. Tyldesley Jones, whom the Companies had consulted, held that the Corporation would have no right to purchase the undertaking if they failed to take the necessary steps within six months from Aug. 18 next. The Corporation have been advised by their Streets Committee that it is inexpedient to exercise the powers either this year or next.

Referring to the wider area, our contemporary added that the Metropolitan Borough Councils Standing Joint Committee have resolved to appoint a Special Committee, to consist of representatives of the London Borough Councils owning electricity undertakings, to consider the desirability of taking immediate steps to provide a joint supply for the Metropolitan area.

The Petrol Process Syndicate, Limited, has been registered with a capital of £21,000, in 20,000 cumulative preference shares (7 per cent.) of £1 each, and a like number of deferred shares of 1s. each.

BIRMINGHAM WATER SCHEME.

A Third Pipe Line.

At a Meeting of the Birmingham City Council last Tuesday—presided over by the Lord Mayor (Lieutenant-Colonel Martineau)—there was an important debate which arose out of the report of the Water Committee.

Alderman Lloyd moved that the Council should decide to proceed at once with the provision of a third pipe on the syphon sections of the aqueduct from Elan Valley to Frankley, and that the Committee be instructed to submit designs and an estimate for the work for the approval of the Council. He said that a year ago the Council decided to apply to the Local Government Board for a Provisional Order to amend the Birmingham Corporation Water Act (1892), so as to permit the Board to sanction loans from time to time to carry out works the construction of which was already authorized by the Act. An inquiry was held, and the Board prepared a Provisional Order, which had passed the House of Commons, was now before the House of Lords, and might be expected to receive the Royal Assent in a few weeks. The duty of the Water Committee that day was to convince the Council that the time had come when the demand very nearly approximated the supply, and when it was absolutely necessary to make definite arrangements for increased provision of water from Wales. What was required was to lay the third of the six pipes contemplated in the original scheme. The Council's officers, Mr. Lees and Mr. Macaulay, had investigated the question closely; and the figures all told the same tale. In addition, a Consulting Engineer had been called in; and his advice was that they could no longer delay the work, and that the third main should be ready for use during the summer of 1918 at the latest. With regard to existing supplies, the Elan Valley had two trunk mains, giving a daily average throughout the year of 24,000,000 gallons; so that were they dependent on the aqueduct only, they were already this year using the full supply the two trunk mains could bring. But they had, in addition, stand-by sources—namely, the wells. These they reckoned at a total of 5,000,000 gallons. They had also the River Bourne—4,000,000 gallons a day, available for a limited time of special pressure—bringing the total to 33,000,000 gallons. The estimated requirements in the year beginning April 1, 1918, according to Mr. Rofe's figures, were practically 34,000,000 gallons a day for the maximum four weeks; and over 29,000,000 gallons became the daily average for the year beginning April 1, 1919. The daily demand last year was already 24,000,000 gallons, the equivalent of the supply carried by the two existing trunk mains; and the demand increased each year at the rate of 1,000,000 gallons. If it were not that they were supplying Coventry, the laying of the pipe could be postponed for two years; but the Committee were still of opinion it was the right policy to supply Coventry. It enabled them to dispose of the water from the River Bourne upon satisfactory terms the whole year round. They

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had already been paid over £40,000 for the water; and the continuous use of the works to supply Coventry sufficed at very slight expense to keep them in full working order for the occasional supply of Birmingham, whenever they might be required. They would be able, if a third pipe were laid, to bring from Wales half of the water they were entitled to. If the increased consumption of water were paid for at the average price per 1000 gallons paid during the first year of the Welsh water, the income of the department would be increased by £25,000 a year. While during the year ended March 31, 1907, 1d. was paid for 104 gallons, the quantity had now risen to 116 gallons for 1d.—an increase of over 11 per cent. in seven years. The late Mr. Chamberlain, when advising the Council to purchase the water undertaking, advised it irrespective of any commercial return. They would, he said, get their profit indirectly in the comfort of the town and the health of the inhabitants. This was true to-day.

Alderman CLAYTON seconded the resolution.

An amendment was moved referring the report back to the Committee, with instructions to them to seek further advice on a "boosting" scheme submitted by Mr. Reid; but this met with scant support, and the Committee's recommendation was adopted *nem. con.*

Mr. F. W. Macaulay, at present the Elan Supply Resident Engineer, was appointed Elan Supply Engineer, at a salary of £1200 per annum; and the Committee were authorized to engage a temporary Assistant-Engineer, at a salary not exceeding £600.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

With the current number of "Chambers' Journal," an inset has been delivered advertising the advantages of an up-to-date coal kitchen-range, in which it is pointed out that "nowadays many people, when they find that their range is out of order, or consumes too much coal, promptly hire a gas-cooker." So far I can entirely agree with the leaflet; but the next statement, "and have their food cooked in gas fumes," is not so satisfactory, nor is the statement that "the gas companies, like the mustard manufacturers, make their profit out of the gas that is wasted in gas-cookers." It is rather curious that in the same leaflet reference is made to the loss of heat through the cast-iron door of the ordinary coal-range oven, and that the doors of the modern type are packed. Seeing that this is entirely due to the example of the common practice adopted in gas-ovens, it is hardly playing the game to run down the gas-cooker. If there be any gas wasted in gas-cookers—and it is certainly very small, if any—how much more heat is wasted in any form of coal cooking-range, however up-to-date it may be. There is, however, a further feature in this leaflet in the name of the firm attached to it. This firm is one of those who are under agreement with the Edinburgh and Leith Corporations' Gas Commissioners "to do everything in its power to bring before its customers the merits of gas for lighting, heating, cooking, and power purposes, and the best methods of utilizing gas for all purposes, and to encourage in any way possible the sale of gas and the best and latest types of gas apparatus." In virtue of this undertaking, the trader is entitled to certain advantages and to fit up complete gas-fires, &c., for the Corporation. Complaint has even been made on behalf of the plumbers that they have not received fair treatment owing to the Gas Commissioners having undertaken the erection and pushing of gas apparatus; but the leaflet referred to shows how the efforts of the trader are expended in the pushing of gas appliances.

In addition to the increase in the consumption of gas in Edinburgh already indicated in this column, the revenue of the electricity undertaking, despite a reduction of ⅛d. per unit (bringing the charge to 2⅜d.), works out at £142,754; so that there is a surplus of £3834, which is about £1400 above the amount estimated. This shows that there is a still expanding consumption of electric current, which appears to be largely on account of motive power uses. The Secretary for Scotland has consented to the Corporation borrowing a further £220,000 in connection with capital works under the Edinburgh Electric Lighting Order, and the consent of the Board of Trade has been obtained for the construction of a generating station at Portobello.

A critical situation has arisen in the Scottish coal trade over the question of the reduction in wages claimed for the coal masters and the decision of the miners to work four days a week only, so that the output should be restricted and prices and wages maintained. Lord Balfour of Burleigh, who was chosen as Arbiter, recently granted a reduction of 6¼ per cent. in the rate of wages. The miners declare that if the men are locked out, as the coalowners threaten, an immediate strike will take place, and they would have the assistance, either by a general stoppage all over the country or by financial aid, to give them the longest fight they had ever had. The four-day policy is to be inaugurated on Monday.

At the annual meeting of the shareholders of the Montrose Gaslight Company—Mr. A. Muirden presiding—Mr. James Mitchell, the Engineer and Manager, in submittting the annual manufacturing report, stated that the year under review had been a record one for the Company, when the prices paid for raw materials and those obtained for residuals were taken into account. The gas manufactured during the year was 41,271,200 cubic feet, which showed an increase of 4,112,300 cubic feet, or 11 per cent., over last year's make. The gas sold showed an increase of 14·99 per cent. on the quantity sold last year. The Manager also reported that during the year attention had been given to distribution, the result of which was a decrease of 2·89 per cent. on the leakage.

At the meeting of the Kinross and Milnathort Gaslight Company, Limited, when a dividend of 10 per cent. was declared and a bonus of 7½ per cent. was paid in addition, Mr. Barnet, of London, said the taking over of the gas-works by the Town Council might be a costly matter for the community, and he feared that the question of the

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town acquiring the works had been rushed into without due consideration. An extraordinary general meeting is to be held on Monday to consider an offer to purchase the works by the Town Council, who have adopted the Burghs Gas Supply (Scotland) Act, 1876.

At the meeting of the Macduff Gas Company the Chairman made feeling reference to the death of Ex-Provost George, who had been a Director of the Company for 50 years, and who had all along taken a leading part in the legal profession, and was for many years Provost of the burgh. Another death was that of Mr. J. W. Simpson, the Chairman of the Company, who had been a Director for 20 years.

At the Buckie Town Council, the Convener of the Lighting Committee stated that a representative of a firm of electrical engineers had called on him suggesting a lighting scheme. He estimated the cost of electricity at 5d. or 6d. per unit, which he stated was equal to 2s. 9d. or 3s. 6d. per 1000 cubic feet of gas, including the upkeep of burners. It is astonishing how these electricians can continue to make such misleading statements, and how the public are apparently ready to swallow them. It has already been pointed out in these "Notes" how the two illuminants may be compared; but the comparison needs some little knowledge of the measurements of electricity and gas, and this knowledge at the time did not appear to be held by certain councillors, who, however, were quite willing to accept the statements of the electrical engineers. Suffice it, therefore, to say that, instead of 2s. 9d. or 3s. 6d. per 1000 cubic feet of gas, electricity at 5d. or 6d. per unit is really equal to gas at 8s. 4d. to 10s., taking the most favourable figures for the electricians.

A further numberof gas companies have been holding annual general meetings, and dividends have been declared thereat. At Inverurie, the Gas Company are to pay 6⅛ per cent., and here the leakage has been reduced to nearly 10 per cent. At Kirriemuir, a dividend of 7 per cent. and a further bonus of 5 per cent. have been declared. The price of gas has been lowered by 2d. per 1000 cubic feet. The Renton Gaslight Company have decided to pay a dividend of 5 per cent. A reduction in the price of gas equal to 5d. per 1000 cubic feet—from 4s. 4½d. to 3s. 11½—has been announced. The price of gas used in cookers has also been reduced by 3d., and now stands at 3s. 6d. The Saltcoats Gas Company have declared a dividend of 18 per cent. and a bonus of 1 per cent. The increase in sales has been over 5 per cent. The Selkirk Gas Company show a slight decrease in the quantity of gas sold, but are paying 5 per cent. dividend. The Tranent Gas Company are paying 6¼ per cent., and are reducing the price of gas to the consumers by 2½d. per 1000 cubic feet. The Lochgelly Gas Company have had a record year, and are paying 7½ per cent. dividend, putting £500 to reserve fund, and carrying forward £537. The Cardenden Gas Company are paying 6 per cent., and putting £300 to the reserve.

Under the title of "Boococks Limited," a Bradford firm of incandescent specialists was registered as a joint-stock company on the 10th inst., with a capital of £3000 in £1 shares.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *July* 20.

Since the last report the position of pitch has remained steady, and to-day's value is 36s. 6d. to 37s. per ton net, at makers' works. Pyridine is firm at 8s. 7½d. per gallon net into buyers' packages, and Creosote at 4d. per gallon, net and naked. Solvent 90-160 is 10¾d. per gallon; benzol 1s. 2d. per gallon; 90 per cent. toluol 11d. per gallon, all net and naked. Anthracene, 40-45 per cent. is 2d. per unit, packages free.

The position of sulphate continues firm, and for 25 per cent. quality, for delivery down to September, makers would not accept below £10 15s. per ton net and naked.

Tar and Tar Products in the Provinces.

July 20.

The average values during the week were: Tar, 24s. 6d. to 28s. 6d. Pitch, east coast, 33s. to 33s. 6d.; west coast, Manchester, 31s. 6d. to 32s. 6d.; Liverpool, 32s. 6d. to 33s. 6d.; Clyde, 32s. 6d. to 33s. 6d. Benzol, 90 per cent., naked, North, 8½d. to 9d.; 50-90 per cent., naked, North, 10d. to 10½d. Toluol, naked, North, 10d. to 10½d. Crude naphtha, in bulk, North, 4¼d. to 4½d. Solvent naphtha, naked, North, 9½d. to 9½d. f.o.b. Heavy naphtha, naked, North, 9d. to 9½d. f.o.b. Creosote, in bulk, North, 3½d. to 3⅝d. Heavy oils, in bulk, 3⅝d. to 4⅛d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 1d. to 1s. 1½d. Naphthalene, £4 10s. to £8 10s.; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1½d. to 1¾d.; "B" quality, nominally ¾d. per unit, packages included and delivered.

Sulphate of Ammonia Prices in the Provinces.

LIVERPOOL, *July* 18.

During the past week the tone of the market has become quieter, but prices have been fairly well maintained. There has not been so much demand from abroad, and dealers in this country seem to have secured their requirements for the time being. The nearest values at the close are £10 18s. 9d. per ton f.o.b. Hull, £11 per ton f.o.b. Liverpool, and £11 2s. 6d. per ton f.o.b. Leith. Little first-hand business has been reported for future delivery, but it has transpired that £11 7s. 6d. per ton f.o.b. good port has been accepted by makers for October-March in equal monthly quantities.

Nitrate of Soda.

There is still no change in the market for this article, and holders on spot repeat quotations at 9s. 10½d. per cwt. for ordinary, and 10s. 1½d. for refined quality.

From another source it is reported that the market for sulphate of

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ammonia has again gone quiet; the last jump in prices evidently stopping business. Outside London, makes are quoted at £10 10s.; Hull, £10 16s. 3d. to £10 17s. 6d.; Liverpool, £10 17s. 6d. to £11; Leith, £11; Middlesbrough, £10 17s. 6d.; while 2s. 6d. to 5s. per ton more is asked for the forward position.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is steady; and the prospect of labour difficulties in Scotland has made the prices firmer here. In steam coals, the demand is good, and for best Northumbrians about 15s. to 15s. 2d. per ton f.o.b. is the current quotation for early delivery. Second-class steams are about 12s. 3d. per ton; and for steam smalls, from 8s. to 9s. per ton is named. The latter kind are somewhat scarce at present. The output is fair; but local holidays affect it a little. In the gas coal trade, there is now an increasing demand. Best Durham gas coals are from 13s. per ton f.o.b.; second-class gas coals are about 12s. 1½d. per ton; and for "Wear specials" from 13s. 6d. per ton f.o.b. is named. The French contracts for gas coal recently mentioned in this report are now concluded, on a basis expected to yield 12s. per ton for best Durhams over a year. The Gothenburg contract has also been closed for special kinds; but the price has not transpired. Other contracts have also been settled at prices, for best Durhams, such as that just mentioned. The completion of these has given firmness to the market, and taken much future coal off it. Coke is steady. Gas coke varies a good deal in price, and may be quoted as from 12s. 3d. to 13s. 6d. per ton f.o.b. in the Tyne.

Municipal Workers' Wages.—A joint meeting of municipal employees in Ashton-under-Lyne, Stalybridge, Dukinfield, Mossley, and Hyde is to be held, to consider what further steps shall be taken with regard to the applications for advances in wages and improved conditions. In the case of Ashton and Stalybridge, the applications are stated to have been sent in four months ago; but nothing has yet been done. A Joint Committee, consisting of representatives of all the towns mentioned, have had one meeting, and a return of existing wages and conditions in each district has been asked for.

Progress of the Clitheroe Gas Undertaking.—Commenting at Thursday's meeting of the Town Council upon the year's operations at the Clitheroe Gas-Works, Mr. W. W. Whiteside, (the Chairman of the Gas Committee) said the amount of gas consumed had increased from 27 million cubic feet to 82 millions during the time he had been a member of the Committee, and that the price had been reduced 33⅓ per cent.—from 3s. 6d. to 2s. 4d. per 1000 cubic feet. At the beginning of the period mentioned, less than half the ratepayers were gas consumers, but to-day the gas consumers outnumbered the ratepayers. The Council were often criticized, but they could at least claim to have conducted the gas undertaking in a progressive manner.

Plymouth Gas Company and their Employees.

The pleasant relations existing between the Plymouth and Stonehouse Gas Company and their employees were evidenced at the annual dinner given by the Company to their workpeople on the 11th inst. Sir Joseph Bellamy, the Chairman, presided over a gathering which numbered 730, and included the wives of the men. Three of the Directors were also present, together with Mr. Percy S. Hoyte (the Engineer and Manager), and other officials. A feature of the programme following the dinner was the performance of selections by the works band—the most recent addition to the social organizations of the undertaking. Mr. J. W. Waters, foreman of the works, expressed the feeling of the employees generally in proposing the toast of the Chairman and Directors. He referred to the pleasant conditions prevailing at the works and the success which had attended the co-partnership scheme, and said that though the Company had experienced a year of trial and difficulty they had pulled through successfully with the valuable help of the Chairman and Directors. It was matter for congratulation that there was no diminution of the profits. Mr. French, another of the foremen, associated himself and his department with the compliments to the Directors. Sir Joseph Bellamy, in reply, said the year had been a very strenuous one; but they had passed through it successfully, and he hoped they would continue working shoulder to shoulder. They ought not to rest until their profits had increased, and the workpeople's share of the profits was 5 per cent. more than now. With honest, hard work they could achieve this end. They possessed a first-class Engineer in Mr. Hoyte, who was ever ready to take advantage of inventions by which the business might be conducted on profitable lines. The Directors and himself were glad of the opportunity of thanking the men for the good services they had rendered during the year; and he trusted the friendly relations between them would continue for many years to come.

Del Monte Trust, Limited.—Under this title a "private" company has just been registered, with a nominal capital of £100,000, in 100 shares of £1000 each, with the following objects: To acquire any mines, minerals, mineral rights, quarries, coal, oil, oil-shale fields, natural-gas fields, or peat deposits, and to develop and turn them to account; to treat coal, shale, peat, and other carbonaceous substances and minerals, and extract therefrom oil, spirits, and other products; to deal in shares, stocks, debentures, and other securities, &c. The first Directors (who are also the signatories to the Memorandum of Association, subscribing for 10 shares each) are Comte Hyacinthe Cagninacci, 94 Rue Saint Lazare, Paris, banker, and Piero M. Salerni, Watergate House, Adelphi, W.C., Director. The qualification for office as a Director is £10,000, and each member holding shares to this amount is to be a Director unless and until he resigns the office. The Secretary (*pro tem.*) is Mr. Frank Coulhard; but the address of the registered office has not been filed.

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Sir Corbet Woodall's Blackburn Report.

In the "JOURNAL" for June 30 [p. 1062] there appeared the report of Sir Corbet Woodall, who was appointed by a Special Sub-Committee of the Blackburn Gas Committee to go into the question of the re-organization and re-construction of the gas-works. The consideration of the report was left to a special meeting, to be called at an early date. The Committee discussed the report for nearly two hours at a meeting last week; and the question was thought of such importance that it was referred to a full meeting of the General Purposes Committee. This Committee constitutes the whole of the members of the Council. It was pointed out that the Corporation were already committed to several costly schemes, and a desire was expressed that there should be something like unanimity before any new outlay was authorized. It was stated that the demand for electricity was growing, and that not long ago a report was prepared recommending a scheme of re-organization involving great expenditure.

Tiverton Gas-Works.—From the annual statement issued by the Borough Treasurer (Mr. J. Siddalls), it appears that actually the gross profit of the Tiverton Corporation gas undertaking last year amounted to £2961. The charges for interest and sinking fund absorbed £2858, leaving £105 to be carried to the reserve fund. The sum of £350 was credited to the borough fund; and the balance to the credit of the reserve fund at the end of the year was £2414. The total amount expended out of loans up to the end of the financial year was £39,313; and of this sum £24,046 has been paid off, or stands to the credit of, the sinking fund, leaving £15,266 as the total charge on loan account, The quantity of gas made last year was 48,897,100 cubic feet; the proportion unaccounted for being 5·7 per cent. There are 1755 consumers, of whom 1140 are on the prepayment system.

Birmingham and the Minimum Wage.

The Birmingham City Council have spent much time discussing a report of the General Purposes Committee, which included a report from the Joint Committee on Labour, relative to a proposal to increase the minimum wage for Corporation employees. One member wanted the minimum increased from 26s. to 30s., and another suggested 28s.; but the Committee said they could not recommend the raising of the present minimum of 26s. per week. The adoption of the report was moved by Alderman Bowater, who urged the desirability of the problem of the standard rate of wages being left for determination by masters and men engaged in ordinary businesses outside the Council. The Council, he pointed out, already paid a minimum wage of 26s., whereas the standard rate outside the Corporation was only 23s. An increase to 30s. would involve a cost to the city of over £63,000 per annum; and considering the minimum wage paid outside, the Committee did not think the Corporation would be justified in granting a further increase. Mr. Yates moved as an amendment the payment of a minimum wage of 28s. per week to men of 25 years of age. He remarked that the increase in that case would be £26,851 per annum, which the Corporation were in a position to pay. Mr. Hallas, in seconding, remarked that if the 28s. were granted it would mean peace for some time; but he should still persist in his endeavour to raise the minimum to 30s. If the 28s. were not granted, means would have to be adopted to obtain it. The amendment was defeated by 59 votes to 40, and the report of the Committee was approved.

Coke-Stack Fire at Blackpool.—A stack of coke containing 1500 tons caught fire at the Blackpool Gas-Works last Tuesday afternoon, and for several hours the fire brigade were engaged in quelling the outbreak.

GAS COMPANIES IN THE STOCK EXCHANGE.

There was no improvement in the general state of things on the Stock Exchange last week, nor indeed can any be expected so long as the country is torn with apprehension of a tremendous calamity, the issue of which is now poised in the balance. In addition to this, critical events abroad are taking place which are themselves of great moment. No wonder that enterprise is suspended, to the great disappointment of all who know that there is plenty of money awaiting investment as soon as the clouds roll by. Under the influence of the general gloom markets in general were depressed, and closed with a fall in values with but few exceptions—of which Consols was one, scoring a rise of ¼ in the week. The opening on Monday was very sluggish, and dulness prevailed generally; the Ulster impasse being the main factor. But later, things picked up somewhat, especially in the gilt-edged group, and Consols rose ¼. Rails moved unevenly. Transatlantics were down; Canadian Pacific being heavily sold. On Tuesday, depression influences were still at work; but Government issues still held up. Some foreign bourses were selling freely in lines they most affect, and dragged down Transatlantics and some Home Rails. Wednesday was inactive and dull, and it was Consols' turn to recede. American rallied a little; and Foreign had a few good points. On Thursday, things shaped rather better. Consols recovered ⅛, and Rails won a little favour. American, however, gave way; and Canadians were shuttle-cocked between Continental sellers and home supporters. On Friday the feeling was less despondent, though it would be hard to say why. Some markets rallied a bit; but business still remained in a debilitated state, and there was not enough doing to show any real recovery. Saturday was as quiet as usual, or more so; the great political question casting a dark shadow over markets. Consols oscillated, closing finally at 75⅛ to 75⅜. The Money Market moved unevenly, but rates closed firm. Business in the Gas Market was again very moderate, which seems destined to be its normal characteristic until the great revival of general activity shall gladden the Stock Exchange. But the tone was satisfactory, and some important issues advanced in value. In Gas Light and Coke, the ordinary was in good request, and changed hands at 103⅝ to 104¾—a rise of ½. In the secured issues, the maximum realized 78, the preference 97¼, and the debenture 73½. Not much was marked in South Metropolitan, but the price was very steady at 102 to 103. In Commercials, the 4 per cent. made 106½, and the 3½ per cent. 104½. Among the Suburban and Provincial group, Alliance and Dublin was done at 60 and 61 (a fall of 2), Brentford old at 263½, South Suburban at 114½ to 115½, and (on the local Exchange) Liverpool "B" at 147 and 147¼ (a rise of 2), and ditto debenture at 98. In the Continental companies, Imperial marked 164½ to 167 (a rise of 1), ditto debenture 85½, Union 78½, and European 18⅛ to 18½—a rise of ⅛. Among the undertakings of the remoter world, Buenos Ayres fetched 85⅛ (a fall of 2), Primitiva 5⅞ and 5⅞, ditto preference 99s. and 100s., and River Plate 86.

OFFICIAL QUOTATIONS AT THE CLOSE OF THE WEEK.

Bank Rate (fixed January 29), 3 per cent. Last year, 4½ per cent. Consols, 75⅛—75¾. Previous week, 75¼—75½.

Issue.	Share.	When ex-Dividend.	Dividend or Interest & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59–64	−2	3 18 2
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76–79*	..	5 1 3
280,000	5	April 29	7½	Bombay, Ltd.	5¼–6⅜	..	5 17 8
50,000	10	Feb. 26	16	Bournemouth Gas & Water — 10 p.c.	29–30	..	5 6 8
352,500	10	,,	7	Bournemouth Gas & Water — B 7 p.c.	15–15½	..	4 10 4
75,000	10	,,	6	Bournemouth Gas & Water — Pref. 6 p.c.	13¾–14	..	4 5 9
380,000	Stk.	Feb. 26	14	Brentford Consolidated	260–265	..	5 5 8
330,000	,,	,,	11	Do. New	204–209	..	5 5 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	109–111	..	4 10 1
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91–93	..	4 6 0
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208–213	..	5 3 4
244,200	,,	,,	8	Do. A Ord. Stk.	154–159	..	5 0 8
580,000	20	Mar. 26	12½	British	44–45	..	5 11 1
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88–93	..	4 8 11
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85–87	−2	4 12 0
100,000	10	—	—	Cape Town & Dis., Ltd.	1½–2½	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4–6	..	—
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70–75	..	6 0 0
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	103–110	..	4 10 11
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106–108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	103–105	..	5 1 6
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½–71½	..	4 3 11
800,000	Stk.	,,	4	Continental Union, Ltd.	78–81	..	4 18 9
200,000	,,	,,	7	Do. 7 p.c. Pref.	115–118	+1½	5 18 8
492,270	Stk.	,,	6	Derby Con. Stk.	123–125	..	4 16 0
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11
1,002,180	10	Jan. 15	10	European, Ltd.	18⅜–18⅝	+⅛	5 7 5
16,386,660	Stk.	Feb. 12	4/17/4	Gas — 4 p.c. Ord.	103–105	+½	4 12 8
2,600,000	,,	,,	3½	Light and Coke — 3½ p.c. max.	76–79	..	4 8 7
4,062,235	,,	,,	4	Light and Coke — 4 p.c. Con. Pref.	96–99	..	4 0 10
4,674,850	,,	June 11	3	Light and Coke — 3 p.c. Con. Deb.	72½–74½	..	4 0 6
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87–89	..	5 12 4
70,000	10	April 29	11	Hongkong & China, Ltd.	16⅜–16⅝	..	6 11 4
131,000	Stk.	Mar. 12	7⅛	Ilford A and C	151–154	..	4 19 0
65,780	,,	,,	6⅛	Do. B	115–118	..	5 3 10
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92–94	..	4 5 1
4,940,000	Stk.	May 14	9	Imperial Continental	163–168	+1	5 7 2
1,235,000	Stk.	Feb. 12	8½	Do. 8½ p.c. Deb. Red.	84–86	..	4 1 5
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119–121	..	5 7 6
561,000	Stk.	Feb. 26	10	Liverpool United A	211–213	+1	4 13 11
718,100	,,	,,	7	Do. B	146–148	+2	4 14 7
306,083	,,	June 26	4	Do. Deb. Stk.	97–99	..	4 0 10

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
75,000	5	June 11	6	Malta & Mediterranean	4½–4⅝	..	6 9 9
250,000	100	April 1	4½	Met. of Melbourne — 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	May 28	4	Monte Video, Ltd.	11⅝–12½	..	6 13 1
1,775,892	Stk.	Feb. 26	4½	Newc'tle&G'tesh'd Con.	99½–100½	..	4 10 0
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	£2–83	..	4 4 4
55,940	10	Feb. 26	7 14 0	North Middlesex 7 p.c.	14–15	..	5 2 8
300 000	Stk.	May 14	8	Oriental, Ltd.	117–122	..	6 11 2
60,000	5	Mar. 26	10	Ottoman, Ltd.	7½–7⅞	..	6 9 0
60,000	50	Feb. 26	13	Portsea, Island B	128–131	..	4 19 3
100,000	50	,,	12	Do. C	118–121	..	4 19 2
249,980	5	April 29	8	Primitiva Ord.	5⅜–6⅛	..	6 8 0
499,960	5	June 26	5	,, 5 p.c. Pref.	4⅞–5⅛	..	4 17 7
521,600	100	June 2	4	,, 4 p.c. Deb.	91–93	..	4 6 0
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85–87	..	4 12 0
150,000	10	May 14	6	San Paulo — 6 p.c. Pref.	10½–11	..	5 9 1
125,000	50	July 1	5	San Paulo — 5 p.c. Deb.	47–49	..	5 2 0
135,000	Stk.	Mar. 12	10	Sheffield A	213–224	..	4 9 3
209,984	,,	,,	10	Do. B	222–224	..	4 9 3
523,500	,,	,,	10	Do. C	220–222	..	4 10 1
90,000	10	May 28	9	South African	10½–11½	..	7 16 6
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111–113	..	4 16 8
1,295,445	,,	July 10	3	Do. 3 p.c. Deb.	72½–74½*	..	4 0 6
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157–159	..	5 6 11
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114–116	..	5 3 5
60,000	,,	,,	5	Do. 5 p.c. Pref.	110–112	..	4 9 3
117,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116–118	..	4 4 9
629,740	Stk.	May 14	5	Southampton Ord.	99–102	..	4 18 0
120,000	Stk.	Feb. 12	7⅛	Tottenham District — A 5 p.c.	135–138	..	5 6 10
543,940	,,	,,	5⅞	Tottenham District — B 3½ p.c.	115–117	..	5 0 5
149,470	,,	June 26	4	Tottenham District — 4 p.c. Deb.	87–89	..	4 9 11
182,380	10	Dec. 30	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93–95	..	5 5 3
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	103½–109½	..	4 11 4
				Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	Wandsworth A 5 p.c.	151–156	..	5 7 4
255,636	,,	,,	6⅞	,, B 3½ p.c.	129–134	..	5 2 7
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110–115	..	5 2 0
352,000	,,	,,	6⅛	Wimbledon 5 p.c.	117–122	..	5 0 5
98,000	,,	,,	6⅜	Epsom 5 p.c.	121–126	..	5 5 2
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66–69	..	4 6 11

Prices marked * are "Ex Div."

Padiham Gas Undertaking.

The ninth annual report of the Engineer and Manager (Mr. A. J. Harrison) was adopted at the monthly meeting of the Padiham Council on Friday. It showed that the expenditure and income during the year were £12,060 and £17,835 respectively, leaving a gross profit of £5775. After allowing £5072 for interest on annuities, and loan and sinking fund contributions, there was a net profit (including £67 bank interest and dividend) of £770. "The past year," observes the Engineer, "will long be remembered as one of the worst years for gas undertakings. The increased cost of coal, the poor market for residuals, together with increased labour costs, had the effect of considerably increasing the cost of manufacture. Yet, notwithstanding these heavy charges, and the reductions made to prepayment consumers, the department has made a gross profit equal to over 11 per cent. on the capital employed."

Hoylake and West Kirby Gas and Water Company.

The report of the Directors and the accounts for the year ending June 30 (which will be submitted at the thirty-seventh ordinary general meeting of the Company) show that the balance at the credit of profit and loss, after payment of the dividends, and transfers to renewals and reserve funds, in respect of the year to June, 1913, is £2202, to which has to be added the net revenue for the past twelve months, £7254—making a total of £9456. Deducting the interim dividend paid in January (£2600), there is available a sum of £6856. From this, the Board recommend the payment of the following dividends: 6 per cent. on the "A" gas original capital; 4½ per cent. on the "B" gas additional capital; 6 per cent. on the "A" water original capital; and 4½ per cent. on the "B" water additional capital. These will absorb £3899, and leave a balance of £2957. After transferring £300 to the water back-dividend reserve, and £811 to the gas, and £239 to the water contingency and plant renewal fund, there is left £1606 to carry forward. The dividend scheme, together with the interim dividend paid in January, represents a total distribution, less income-tax, for the year of 10 and 7 per cent. on the "A" and "B" capitals respectively. The Directors announce their intention of paying a further dividend of 2½ per cent., thus completing the maximum dividend on the "A" water capital, for the year ending June 30, 1883. The quantity of gas supplied last year to private consumers and to the public lamps was 64,492,150 cubic feet. The price of gas during the period under review was 3s. 4d. per 1000 cubic feet, less varying discounts; while the charge to users of prepayment meters was 4s. 2d.

Sidmouth Gas Undertaking.—At the last meeting of the Sidmouth Urban District Council, Mr. Halse referred to a statement which had been prepared setting forth the financial result of the working of the gas undertaking for the nine months since it was taken over by the Council. The showing, he said, was extremely satisfactory, and the Gas Committee would not have to go to the ratepayers for a penny. He thought the Council would find the works a very remunerative investment.

Ownership of the Gatehouse Gas-Works.—The gas-works at Gatehouse (Kirkcudbrightshire) which were built over sixty years ago, have been taken over by Messrs. Firth Blakeley, Sons, and Co., Limited, of Dewsbury and Church Fenton. During the few months the works have been in their hands, the firm have largely reconstructed them, and have put the whole concern into an up-to-date condition. Besides this they have lowered the price of gas from 9s. 6d. to 8s. 4d. per 1000 cubic feet, and are hoping that during the next few months increased consumption may enable them to make a further reduction.

Increase in Price of Gas at Stratford-on-Avon.—By a majority of one, the Stratford-on-Avon Town Council have adopted a recommendation of the Finance Committee that the price of gas be increased 2d. per 1000 cubic feet from Sept. 30, such increase not to affect the charge for gas supplied through prepayment meters or to Snitterfield. Mr. Tyler and Alderman Smallwood said the proposed step would be a great injustice to the gas consumers; the former pointing out that the undertaking had always paid the sinking fund and interest charges, and so far had not cost the ratepayers a penny. Mr. Smith, on the other hand, argued that coal had gone up 20 per cent. in the last few years, while the proposal was to increase the price of gas 5 per cent. This was sound finance. The thing was to keep the rates down.

APPLICATIONS FOR LETTERS PATENT.

16,046.—Gareis, O., "Mantles." July 6.
16,071.—M'Court, C. D., "Gas-burners." July 6.
16,081.—Lüdemann, H., "Attaching mantles." July 6.
16,132.—Ehrich and Graetz, "Compressed-gas lamps." July 6.
16,147.—Jackson, G. M., "Pipe-joints." July 7.
16,184.—Maschinenfabrik Augsberg-Nürnberg Akt.-Ges., "Gasholders." July 7.
16,199.—Julius Pintsch Akt.-Ges., "Vertical gas-generators." July 7.
16,233.—Keith, J. & G., "Lighting and extinguishing lamps." July 7.
16,393.—Haarer, E. du C., "Controlling gases, &c." July 9.
16,465.—Feilmann, M. E., "Non-return valve." July 10.
16,472.—Maschinenfabrik Augsburg-Nürnberg Akt.-Ges., "Erection of gasholders with disc-shaped closing-members." July 10.
16,473.—Maschinenfabrik Augsburg-Nürnberg Akt.-Ges., "Packing and sealing means for gasholders having a disc-shaped closing-member or crown." July 10.
16,541.—Foster, J. H., and Thomas, L. J., "Manufacture of solid tar or pitch." July 11.
16,542.—Crossley, H., "Grids for purifiers." July 11.
16,553.—Wilson, H. F., "Water-heaters." July 11.

Neath Gas Affairs.—The following is taken from last Saturday's "Western Mail": There are indications of trouble at the Neath Corporation Gas-Works. At a meeting of the Committee, a recommendation to decrease the Manager's salary by £50 per annum was unanimously arrived at. This recommendation cannot, of course, become operative until the full Council endorses the opinion of the Gas Committee. The workmen at the gas undertaking, including the clerical staff, are in sympathy with Mr. R. A. Browning, the Manager, and state that they will all "down tools" if the Committee's recommendation is confirmed by the Council. Fifty-five applications were considered by the Gas Committee on Friday for the new post of financial officer for the gas undertaking, at a commencing salary of £150. These were reduced to five.

Public Lighting of Wem.—Much time was taken up at the last monthly meeting of the Wem Urban District Council over a discussion on the vexed question of public lighting. Some four columns of the local paper are devoted to the subject; and from the speeches reported it appears that, owing to some difficulty with the Gas Company, the ten lamps which would be lighted at the present time under ordinary conditions are unlit. Precisely what is the extent of the Company's shortcomings (if any) it is not easy to gather; but by one member they were accused of the serious offence of treating the Council "as if they were of little or no importance," inasmuch as the tender they sent in did not in every respect conform to the conditions laid down. Meanwhile, the Council have before them an electric lighting proposal; and an agreement has been drawn up with the promoter, under which the Council are of opinion that "they have taken care of themselves pretty well." There is to be nothing uncertain about the public lighting contract at Wem.

We have just received from the Ellwhite Gas-Stove Company, Limited, of No. 25, Newman Street, W., an illustrated price list of their "Ellwhite" stove, which was described in the "Journal" for March 24 last, p. 808. The photographs show the hot plate, the interior of the stove, the boiling-ring at the side, and the boiler at the back. The oven is of the closed type; and great economy in gas consumption is claimed for the stove.

An electrician named Dorsett has been electrocuted while working at Messrs. Jordan and Sons' factory at Bilston. He was in the act of changing a belt from one pulley to another, which was connected with a dynamo, when his hand got locked. His mate, named Butler, saw that all was not well, and mounted a ladder to release Dorsett. In doing so, he experienced a severe electric shock; and both men fell to the ground. On examination, Dorsett was found to be dead.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Lady Show-Room Attendant. No. 5915.
Assistant Engineer and Manager. Oldbury Urban District Council. Applications by July 27.
Assistant Engineer and Manager. Torquay Gas Company. Applications by July 25.
Draughtsman. Davis Gas Stove Company, 200, Camberwell Road, S.E.
Show-Room Attendant. No. 5914.
Show-Room Storekeeper and General Works Clerk. No. 5917.
Stoker (Leading). Herne Bay Gas-Works.
Stoker. Gas-Works, Pontyclun.
Gas Fitters. No. 5911.

Appointments Wanted.

Charge of Works, &c. No. 5919.

Plant, &c. (Second Hand), For Sale.

Pipes and Governor, &c. Cannock, &c., Gas Company.
Exhauster and Mannesmann Steel Springs. Glastonbury Gas-Works.
Street Lamps. Rawtenstall Corporation.
Gasholder, Retorts, and Purifier. C. & J. Clark, Limited, Street, Somerset.
Hydraulic Main, Dip Pipes, &c. Bideford Gas Company.
Exhauster. Newcastle-on-Tyne Gas Company.
Saturator, &c. Yorkshire Semet-Solvay Company. Sheffield.

Plant, &c. (Second Hand), Wanted.

Rotary Meter. No. 5918.

Gas-Works for Disposal. No. 5916.

Gas-Works Wanted.

"D. G.," c/o Scripps's Advertising Offices.

Meetings.

South Metropolitan Gas Company. De Keyser's Hotel. Aug. 12. Two o'clock.
South Suburban Gas Company. De Keyser's Hotel, Aug. 14. Three o'clock.

TENDERS FOR

Coal.

Doncaster Gas Department. Tenders by Aug. 14.
Haworth Urban District Council. Tenders by July 24.
Hereford Gas Department. Tenders by July 25.
Heywood Gas Department. Tenders by Aug. 11.
Rochdale Gas and Electricity Department. Tenders by Aug. 5.
Rothwell Urban District Council. Tenders by July 27.
Tralee Gas Department. Tenders by Aug. 3.

Gas-Works (Complete).

Lodz (Russian Poland) Municipality.

General Stores (Acid, Tinned Ware, &c.).

Heywood Gas Department. Tenders by Aug. 11.

Lamps, &c.

Calcutta Corporation. Tenders by Aug. 31.

Oxide of Iron.

Rochdale Gas and Electricity Department. Tenders by Aug. 5.

Pipes, &c.

Heywood Gas Department. Tenders by Aug. 11.
Mansfield Gas Department. Tenders by July 28.

Tar and Liquor.

Mansfield Gas and Water Department. Tenders by July 28.
Wandsworth, &c., Gas Company. Tenders by July 30.

We have received from Messrs. James Milne and Son, Limited, Section VI. of their gas apparatus catalogue. It furnishes illustrated particulars of compressors, &c., for high-pressure gas, and of single and multiple burner lamps.

A motor-car collision occurred at Knowle, Somerset, last Sunday week, by which extensive damage was done to the vehicles concerned, but fortunately no serious personal injury resulted. In one of the cars was Mr. Hutchison, of Barkstone Gardens, S.W., the proprietor of extensive tar-works at Highbridge, who was touring with another gentleman and three ladies. Mr. Hutchison, whose face was badly cut, and a boy from the other car were taken to the hospital for treatment, but neither was detained.

An inquest has been held at Immingham upon the body of John Joyce, a ship's painter, who was killed through coming in contact with a live wire while engaged in the graving dock. He was working by the aid of a powerful electric light; and it is supposed that he moved a fitting which he ought not to have done, and that in tugging at a flexible cable he broke it, thus receiving the full force of the current. The Jury found that deceased died through an electric shock, but that there was not sufficient evidence to show how it was caused.

The Directors of the Tottenham District Light, Heat, and Power Company recommend (subject to the completion of the audit) the payment of a 5 per cent. per annum dividend on the preference stock and the full statutory dividends of 7½ per cent. per annum on the "A" consolidated stock and 6 per cent. per annum on the "B" consolidated stock. A year ago the dividends on the consolidated stocks were at the rate of 7⅜ and 5⅞ per cent.

At the Sussex Agricultural Show, the Eastbourne Gas Company erected a large marquee which was a centre of attraction for ladies. It contained a monster kitchen, with numerous gas-stoves and other appliances for ensuring good cooking combined with economy. Her Majesty the Queen of Greece, with her suite, one day spent quite a long time watching a cookery competition open to ladies of Sussex, who were cooking and preparing trays of afternoon tea. Her Majesty asked many questions of Miss Randall, who superintended the various competitions, and expressed her preference for certain of the tempting cakes and scones which were being made in her presence. The successful competitors included some Red Cross nurses, past and present students of the Eastbourne Technical Evening School, children representing the elementary schools, and ladies of Sussex.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

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O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

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PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

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SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED.
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Telegrams: "CHEMICALS, OLDBURY"

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CARBONIZING and Boiler Setting Engineers, Complete Installations undertaken.
Their Retort Settings are THE best.
GUARANTEED RESULTS.
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London Office: 53, VICTORIA STREET, S.W.
Telephone: 3512 VICTORIA.
Manchester Office: 55, CROSS STREET.

TAR WANTED.
OUTSIDE THE TAR RING.
ESTABLISHED A QUARTER OF A CENTURY.
THE Burnden Tar Company (Bolton), Ld.
HULTON CHEMICAL WORKS, BOLTON.
JOSEPH A. HUTCHISON, Managing-Director.

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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
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with which is amalgamated WM. PEARCE & SONS, LTD.
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Telegrams: "HYDROCHLORIC, FEN, LONDON."
Telephone: 1588 AVENUE (3 lines)

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
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Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
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CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD
SALISBURY HOUSE, LONDON WALL, E.C.
Telephones: 4452 and 4453 London Wall.
Telegraphic Address: "Carburine, London."

TAR Wanted.
FREDK. G. HOLMES AND CO., Tar Distillers, Thames Tar Works, NORTHFLEET.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.
RETORT SETTINGS, COAL TESTING PLANT BOILER FIRING.
Communications should be addressed to
UNDERWOOD HOUSE, PAISLEY.

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Telephone 5 Brownhills. Established 1840.
Best Prices Paid.
BROWNHILLS CHEMICAL WORKS COMPANY,
BROWNHILLS, NEAR WALSALL, STAFFS.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, near LEEDS.

OXIDE OF IRON.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
"KLEENOFF." THE COOKER CLEANER.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

TAR WANTED.
THOMAS HORROCKS & SONS, LTD.,
Albert Chemical Works,
NORTON STREET, MILES PLATTING, MANCHESTER,
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

TAR WANTED.
OUTSIDE THE TAR RING.
JOSEPH A. HUTCHISON, LIMITED,
HIGHBRIDGE WHARF, SOMERSET,
AND
25, HOLLAND STREET, BLACKFRIARS, S.E.
JOSEPH A. HUTCHISON, Managing-Director.
D. S. MACDONALD, Secretary.

TO GAS AND WATER OFFICIALS.
BEFORE Purchasing your 1914 Cycle kindly send post-card for our CATALOGUE, Cash or gradual Payments. Speciality, Slot-Meter Copper Collector. MELROSE CYCLE CO., COVENTRY.

SPENCER'S PATENT HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, June 16, p. 752.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
JOHN RADCLIFFE AND CO., Chemists and Engineers, Winchester House, OLD BROAD STREET, E.C.

FOR Renovating Cooking Utensils and Polishing Gas-Cookers and Gas-Fittings, read Canning's Handbook on Electro-Plating and Polishing. Fully illustrated, Price 2s. 3d., post free; abroad, 2s. 6d.
W. CANNING AND CO., BIRMINGHAM, and 18, St. John's Square, Clerkenwell, LONDON.

ROBERT DEMPSTER & SONS, Ltd. Contractors for Complete CARBONIZING PLANTS and every Description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, Rose Mount Ironworks, Elland.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable: quality and results, the *best*. Satisfaction Guaranteed.

SULPHURIC ACID — Specially prepared for Sulphate of AMMONIA and BENZOL Recovery Plants. John Nicholson & Sons, Ltd., Hunslet Chemical Works, Leeds. Tele.: "Nicholson, Leeds." Telephone: (Two Lines) Nos. 2420 and 2421.

AMMONIACAL Liquor Wanted. Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs. Telegrams: "Chemicals."

PATENTS AND TRADE MARKS PUBLICATIONS: "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d. MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants. We Guarantee promptness with efficiency for Repairs. Joseph Taylor and Co., Central Plumbing Works, Bolton. Telegrams: "Saturators Bolton," Telephone 0848.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services. It is also used for the Enrichment of Gas. Manufactured and Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agents, F. J. Nicol & Co., Pilgrim House, Newcastle-on-Tyne. Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

LIMESTONE Containing 99·7 Per Cent. of Carbonate, Porous and Easily Crushed. Cheap. Inquiries Invited. Lloyd's Ironstone Company, Limited, Corby, Kettering.

APPLICANTS for the Position of RENTAL CLERK to the British Gas Light Company, Limited, Norwich Station, are THANKED for their Applications, and are informed that the POSITION HAS NOW BEEN FILLED.

EMPLOYMENT Wanted, by person having Life Long Experience of small Gas Undertakings (40 Millions to 10 Millions), every Department—Indoor and Outdoor, including Accounts Collecting, ordering all Materials, Full Charge of Staff, &c. Address No. 5919, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

LADY ATTENDANT FOR SHOW-ROOM.

YOUNG Lady of Good Education and Address, with a Training in Show-Room Work and Sales, and having a Thorough Knowledge of all Modern Gas Appliances, required by a Gas Undertaking in Scotland. Apply, by letter, stating Age, Experience, Training, and Salary required, to No 5915, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TEMPORARY Draughtsman Wanted. Possibility of Permanency for Suitable Man. Apply, by letter only, stating Age, Experience, and Salary required, to Engineer, the Davis Gas Stove Company, Limited, 200, Camberwell Road, S.E.

ASSISTANT ENGINEER AND MANAGER.

FULLY Qualified Assistant Engineer and Manager required by the Torquay Gas Company, with Practical Experience of Modern Methods of the Manufacture and Distribution of Gas, including Carburetted Water Gas and Sulphate of Ammonia Plant. Salary to commence, £150 per Annum. Age not under 26. Application, with *copies* of Testimonials, to be addressed to the undersigned not later than July 25.

S. H. Easterbrook,
Secretary.

THE Urban District Council of Oldbury require an ASSISTANT ENGINEER and MANAGER, with Good Practical Experience in Manufacture and Distribution of Gas, and capable of Supervising Men. One with Experience in Constructional Work preferred. Salary, £150 to £200 per Annum. Applications, with full Particulars, stating Salary required and *copies* of Two recent Testimonials, to reach the undersigned (in envelopes marked "Assistant Gas Manager") on or before Monday, the 27th of July, 1914.

Sydney Vernon,
Clerk of the Council.

A Gas-Works in the Midlands requires a Competent and Trustworthy SHOW-ROOM ATTENDANT, with previous Experience in a Similar Position. Wages, 30s. per Week. Address, No. 5914, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SHOW-ROOM STOREKEEPER AND GENERAL WORKS CLERK.

WANTED, for a 25 Million Cubic Feet Works in Surrey, an Energetic Young Man, about 27 to 30 Years of Age, for Works as above. Wages, commencing, 30s. per Week. Applications, in own Writing, stating clearly particulars of Experience, together with *copies* of recent Testimonials, to No. 5917, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SEVERAL Gas-Fitters required by a large Gas Company in the South of England. Wages 30s. per Week of 54 Hours. Applicants must be good Meter Index Readers, and well up in Slot Installation work. Apply, by letter, to No. 5911, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

STOKER Wanted, as Leading Hand. Permanent Employment to Suitable Man, Height 6 feet. State Age, Experience, and whether Married or Single. Must be used to Boilers, Engines, and Exhausters. Wages, 36s. Weekly. None but those whose Character will bear Strict Investigation need apply. C. V. Bennett, Gas-Works, Herne Bay.

STOKER Wanted, for a 7 Million Works. Must be Good Shovel Charger, Steady and Reliable. Yardman kept. Wages, 35s. per Week of 6½ days. One Week's Holiday in Summer with pay. Apply to Arthur Escott, Gas-Works, Pontyclun, Glamorganshire.

WANTED, a Second-Hand Rotary METER, 30,000 Cubic Feet per Hour Capacity. Must be in First-Class Condition. State Age, Gas Passed, and Lowest Price f.o.r., to No. 5918, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GAS-WORKS.—Wanted to Purchase, for Cash, a Small GAS-WORKS. Preference given to one where there is Scope for Further Development. Write, giving full Particulars, to "D. G.," Scripps's Advertising Offices, 13, South Molton Street, W.

PURIFIERS.—Set of Three 8 feet Square, Planed Joints, 8-inch Valves. Perfect. Cheap to clear. Address No. 5907, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

PURIFIERS.—Two 6 feet Square; Two 8 feet Square; Two 12 feet Square; Two 18 feet Square. Guaranteed and Cheap. Valves, &c., Complete. Firth Blakeley, Sons, and Co., Ltd., Church Fenton, Leeds.

COMBINED Engines and Gas Exhaus- TERS.—Waller's Three-Blade. 4000 and 6000 feet per Hour. Guaranteed. Seen Running. Cheap. Firth Blakeley, Sons, and Co., Ltd., Church Fenton, Leeds.

GASHOLDER (35,000 feet Capacity), TANK, &c., Complete. Could be Re-erected Cheaply. Address No. 5908, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SATURATOR, Cast-Iron Casing, 5 ft. 6 in. Diameter by 5 ft. Deep, Walkers' Self Discharging, Lined ¾-inch Lead, Complete with Supporting Columns, Draining Table, and Mother-Liquor Tank. Not been used. What Offers? The Yorkshire Semet-Solvay Company, Limited, 155, Norfolk Street, Sheffield.

FOR SALE—One Two-Blade Gas- EXHAUSTER, made by Bryan Donkin Company, Limited. Capacity, 60,000 to 70,000 Cubic Feet of Gas per Hour at 60 revolutions per minute. Complete with Coupling and Lubricators. Apply to the Newcastle and Gateshead Gas Company, 35, Grainger Street West, Newcastle-on-Tyne.

SMALL Gas-Works for Sale, Freehold. Part Money may remain properly secured. Address No. 5916, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—Three-Blade Waller EXHAUSTER, 300 Feet per Hour, for 5-inch Connections. In first-class Condition. Replaced by larger one. Also Four 10-inch ¼th MANNESMANN STEEL SPRINGS, in use Two Months for Temporary Purpose. No Reasonable Offer refused. Apply to the Manager, Gas-Works, Glastonbury.

CORPORATION OF RAWTENSTALL.

ON SALE—About 150 Cast-Iron Street Gas Pillar LAMPS. Further Particulars can be obtained from the Lighting Superintendent, Central Fire Station, Rawtenstall. Offers to be sent to the Town Clerk, Town Hall, Rawtenstall.

FOR SALE—One Gasholder 12 feet High, Diameter 30 feet; also Five new GAS RETORTS and One PURIFIER. All in Good Working Order. Offered on Site at Boot Factory of C. & J. Clark, Limited, Street, Somerset.

BIDEFORD GAS AND COKE COMPANY, LIMITED.

FOR Disposal—Four Lengths of HYDRAULIC MAIN, fitted with Six 5-inch DIP PIPES and TAR OUTLETS; and Twenty-four ASCENSION and H PIPES. Apply to the Manager, Gas-Works, Bideford.

CANNOCK, HEDNESFORD, AND DISTRICT GAS COMPANY, LIMITED.

THE above Company have for Dis- posal about 400 Yards of 8-inch and about 400 Yards of 4-inch Cast Iron Socket and Spigot PIPES, and one 10-inch Parkinson GOVERNOR, with Connections. Any further Information can be obtained from the undersigned.

T. A. Nicholls,
Secretary.

NEW GAS-WORKS.

NOTICE is Hereby Given that New GAS-WORKS are to be Erected in Lodz (Russian Poland). The Board of Management invite Tenders for same. All Firms interested can obtain Detailed Information and Specifications regarding the new Works on Application to the Board of Management, Targowa 34, Lodz.

Board of Management,
Lodz Municipal Gas-Works.

Lodz, July 10, 1914.

CORPORATION OF CALCUTTA.

TENDERS are invited in duplicate for the Supply of 70 High-Power Low-Pressure INVERTED INCANDESCENT GAS ARC LAMPS and BURNERS, complete with Harp Shape BRACKETS for fixing to existing Lamp Columns. The above Lamps are required, complete with Burners, Globes, Mantles, and all other necessary parts, and must be of about 600-Candle Power. Tenders must also include Prices for Mantles and all other parts for Maintenance. Illustrations, with full Measurements and all other Details of the Lamps quoted for, must be supplied by the Tenderers. The earliest time for Delivery of the full quantity must be stated. Tenders must include Delivery Free of all Charges at the Corporation Lighting Stores, Calcutta, including Insurance against Breakages. The Corporation do not bind themselves to accept the lowest or any Tender, and will be at liberty to accept the whole or part of a Tender. Payment will be made when Delivery is accepted. Tenders will be received by the Vice-Chairman of the Corporation up to 2 p.m. on Monday, the 31st of August, 1914, when they will be opened in the presence of such Tenderers as may be present. Each Tender must be enclosed in sealed cover and superscribed "Tender for Inverted Incandescent Gas-Lamps and Brackets." No Tenders will be considered unless accompanied by a remittance to the extent of 2½ per cent. on the total value of such Tender. The rates offered by the Tenderers will be in force for the whole year. Tenderers must abide by the rules in regard to Tenders in vogue in the Corporation, and are required to submit Tenders on their own Forms in Terms of this advertisement.

C. C. Chatterjee,
Secretary to the Corporation.

Municipal Office:
Dated July 1, 1914.

BOROUGH OF DONCASTER.

TENDERS FOR COAL.

THE Gas Committee of the Borough of Doncaster are prepared to receive TENDERS for the Supply of 30,000 Tons of Best Screened GAS COAL NUTS during the Year ending June 30, 1915. Particulars and Tender Forms may be obtained on Application to the undersigned. Tenders, endorsed "Coal," should be sent under Seal to the Chairman, and received at the Corporation Gas-Works, Doncaster, not later than 10 a.m. on Friday, the 14th of August next. By order of the Gas Committee, who do not bind themselves to accept any Tender.

Robt. Watson,
Engineer and Manager.

Corporation Gas-Works,
Doncaster, July 17, 1914.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the Supply of TUBES and FITTINGS, ACID, and TINNED WARE. Specification and Form of Tender may be obtained from Mr. W. Whatmough, Gas Manager. Sealed and endorsed Tenders to be sent to me not later than Tuesday, Aug. 11, 1914.

By order,
Geo. G. Bouchier,
Town Clerk.

Municipal Buildings, Heywood,
July 15, 1914.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the Supply of 12,000 Tons of COAL. Specification and Form of Tender may be obtained upon Application to Mr. W. Whatmough, Gas Manager. Sealed Tenders, endorsed "Coal," to be sent to me not later than Tuesday, Aug. 11, 1914.

By order,
Geo. G. Bouchier,
Town Clerk.

Municipal Buildings, Heywood,
July 15, 1914.